4 DECEMBER 1952

ONE SHILLING

FLIGHT

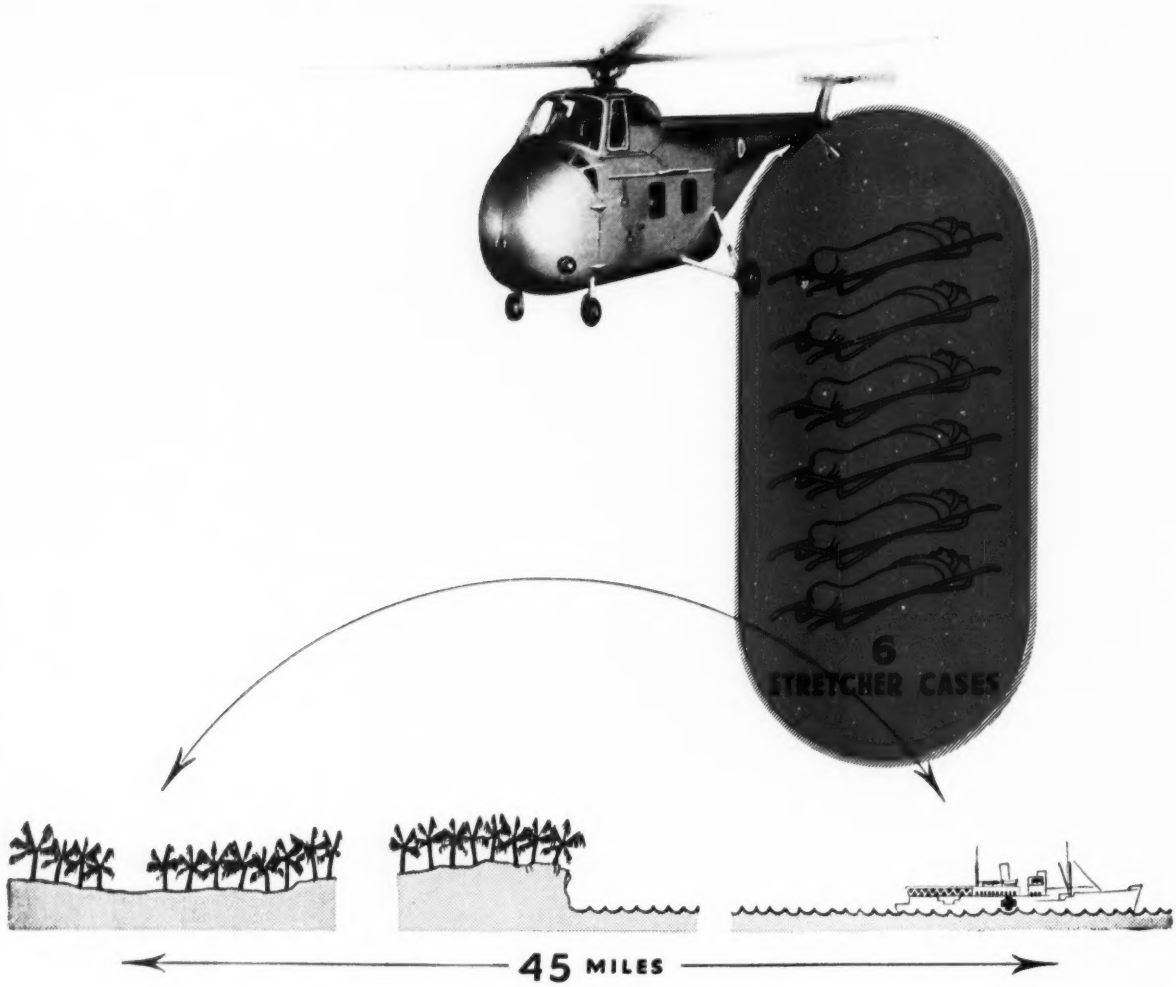
and

AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

Every British Aircraft relies on **Plessey**

BARBER



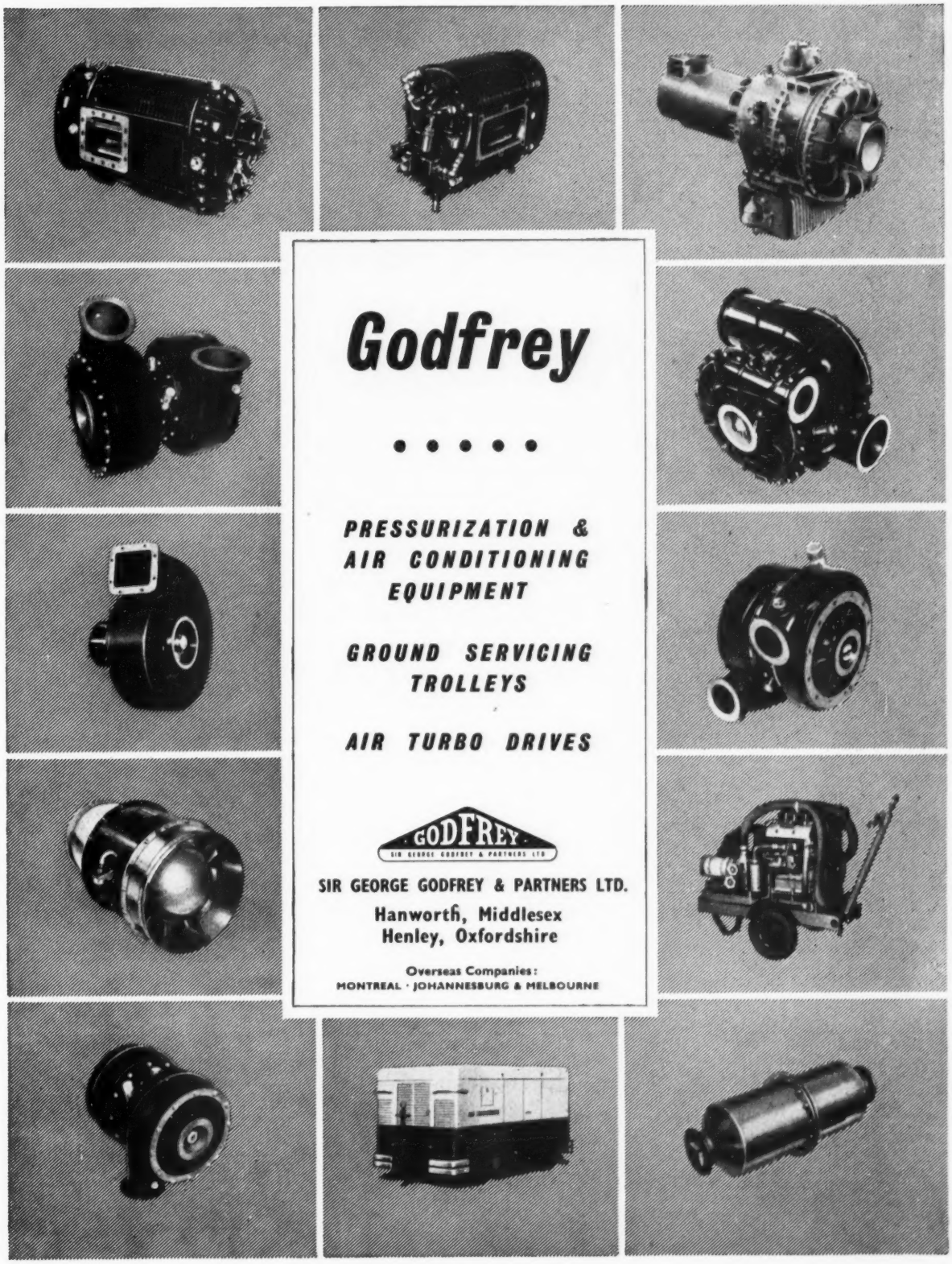
What other available vehicle can pick up six stretcher cases from a forest clearing 50 yards by 40 yards and convey them to hospital (or even on hospital ship deck) 45 miles away in one hour round trip ?

only WESTLAND *HELICOPTERS*

Give you the answer!

WESTLAND AIRCRAFT LIMITED · YEOVIL · ENGLAND

CABLES: AIRCRAFT, YEOVIL



Godfrey

• • • • •

PRESSURIZATION & AIR CONDITIONING EQUIPMENT

GROUND SERVICING TROLLEYS

AIR TURBO DRIVES

GODFREY
SIR GEORGE GODFREY & PARTNERS LTD

SIR GEORGE GODFREY & PARTNERS LTD.

Hanworth, Middlesex
Henley, Oxfordshire

Overseas Companies:
MONTREAL · JOHANNESBURG & MELBOURNE

Because magnesium is the lightest of all structural metals, and the easiest to machine, all production jobs involving the use of *Elektron Magnesium Alloys* start with assured advantages in *time, power, equipment, man hours, floor space and tools.* The economical 'machinability' of these alloys is as important to the Production Engineer as their lightness is to the designer—one of the reasons why Elektron castings are being used for jet engines, omnibuses and heavy commercial vehicles, in textile machinery and in some 250,000 Ferguson tractors. Write for a copy of our booklet on "Machining".

ELEKTRON

MAGNESIUM ELEKTRON LIMITED

CLIFTON JUNCTION MANCHESTER

London Office: Bath House 81 Piccadilly W.1

The Short Seamew

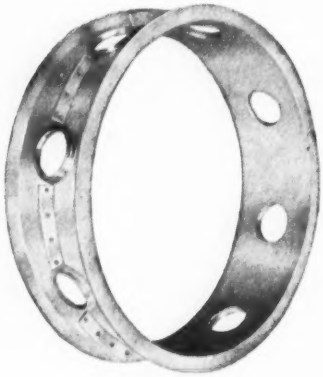
THIS IS A VERY SHORT STORY — the story of an early bird — the SEAMEW. Just an idea eighteen months ago, it is *now* in quantity production for the Royal Navy. THE SHORT SEAMEW — low in initial cost, economical to operate and maintain.

Simple — Rugged — Efficient

THE FIRST MANUFACTURERS OF AIRCRAFT IN THE WORLD *Short Bros. & Harland, Ltd., Queens Island, Belfast, Northern Ireland*

EVERYTHING IN SHEET METAL WORK

FOR AIRCRAFT AND AUTOMOBILE



CABINETS for RADAR, RADIO and TELEVISION

DYNAMO and MOTOR CASES

COACH AND BUS BODIES

Municipal and other ALL METAL Vehicle Bodies

Refrigeration

COLD STORAGE

HEATING

DRYING

Air Conditioning

MINING

Light Assemblies Components and STRUCTURES in SHEET METAL

TELEGRAMS: BROMELPAR, SOUTHTOT, LONDON

TELEPHONES: TOTTENHAM 2257, 2258 & 2259

E. G. Brown & Co. Ltd

161 WEST Rd., TOTTENHAM

LONDON, N.17

KLM ROYAL DUTCH AIRLINES

Giant Liftmasters make light work of all cargoes

The biggest scheduled air-freighters in the air, Douglas D.C.6-A Liftmasters now fly on KLM Services with loads of a size no other commercial aircraft can take.

Liftmaster capacity is enormous — 5,000 cubic feet — equivalent to two large railway vans. Because of this and two exceptionally large upward-opening doors, massive machinery, turbines, propeller shafts weighing up to eleven tons now speed swiftly and smoothly across the world.

For transporting goods of every kind, delicate or perishable, bulky or weighty, KLM Liftmasters mean lower costs and higher speeds with far easier, more efficient handling.

All details from your Freight Agents or KLM Royal Dutch Airlines (Freight Division), 21 Jockey's Fields, Holborn, London, W.C.1. Telephone: Mayfair 8803.

BOULTON PAUL AIRCRAFT LTD
WOLVERHAMPTON, ENGLAND

FIRE safety

watch for still MORE new developments in

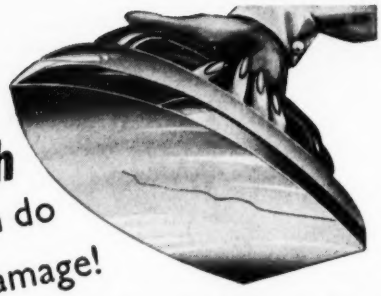
Pyrene TRADE MARK FIRE FIGHTING EQUIPMENT

The advance towards complete Fire protection for Aircraft is moving steadily forward—Pyrene Smoke Detectors and CO_2—Duo-head Fire Extinguishing Systems are now extensively installed on leading civil air liners. New safeguards for aircraft include Pyrene Fire Detectors, Visual Smoke Indicators and Aircraft Wheel Chocks. Write now for new illustrated literature describing the latest Pyrene Fire and Safety equipment for Aircraft and Airfields. Dept. FL.12.

THE PYRENE COMPANY LIMITED

9, Grosvenor Gardens, London, S.W.1. Tel. : VICtoria 3401

Just a **scratch** ...but it can do £££ of damage!



Protect precision-ground parts, expensive components, crankshafts, airscrews, turbine blades, injection equipment and projecting members of machines, by covering or lapping with Black Seal Waterproof Fabric Tape. Wherever high-value products are handled, transported, stored and assembled, the resilient strength of Black Seal provides dependable protection at comparatively low cost.

BLACK SEAL

Glossy WATERPROOF Fabric Tape

***prevents* damage**

Samples gladly from

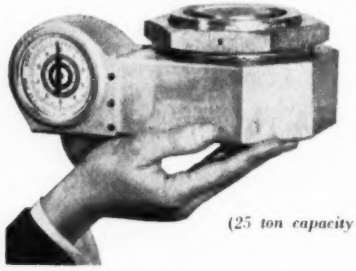
Gosheron

fulfils MOS (CS 2191) AID, CCI, IFV, PPCO, IEME, and Admiralty (K1359) requirements.

John Gosheron & Co Ltd Gayford Road London W12

The

B.O.A.C. HYDROSTATIC WEIGHING UNIT



(25 ton capacity unit illustrated)

- ACCURATE
- PORTABLE
- RELIABLE

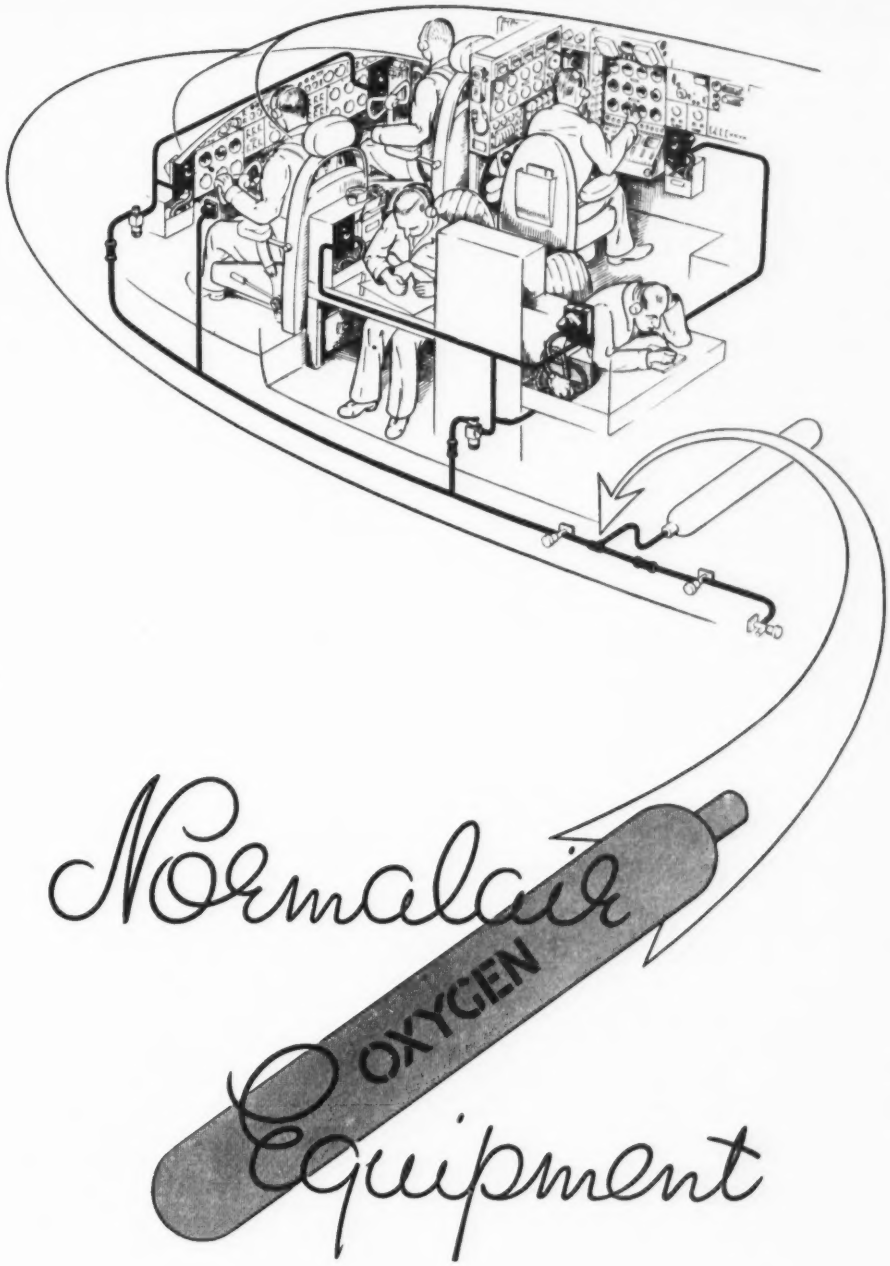
ALL ENQUIRIES TO THE SOLE DISTRIBUTORS

KENTON EQUIPMENT Ltd.

708, KENTON ROAD, KENTON, HARROW MIDDLESEX

WORdsworth 7803 (5 lines)

Manufactured by ALLTOOLS LTD., GT. WEST ROAD, BRENTFORD, MIDDLESEX



The Oxygen System of a typical large Transport Aircraft as designed by NORMALAIR LTD., manufacturers of Cabin Air Conditioning and High Altitude Breathing Equipment.

NORMALAIR LTD · WEST HENDFORD · YEOVIL · ENGLAND

How would I get on in the Fleet Air Arm?

Pretty well, I'd say. If you like flying, there's lots of it. If you like the sea, there's plenty of that too! The pay's good and so are the chaps in the wardroom. And if you want to stay on, you have the chance—or you can come out knowing you've got a better start than most. I think you'd be wise to choose the Fleet Air Arm.

How will the next few years profit you? They can be the most memorable of your life; and perhaps the most useful. By taking a Fleet Air Arm commission — as a pilot or observer — you share in the adventure and the responsibility of flying in the Royal Navy. Pay is good. Leave is generous. Your service will have been a worthwhile experience and an invaluable help towards your future career.

There are two methods of entry:

1. On a SHORT SERVICE COMMISSION. You serve for 8 years and at any time during this period you have a good chance of qualifying for a permanent commission. Or you can come out with a very useful gratuity of £1,500.

2. On a NATIONAL SERVICE COMMISSION which you can if you wish extend to 4 years to qualify for a gratuity of about £500, or to 8 years with a good chance of qualifying for a permanent commission or coming out with an increased gratuity.

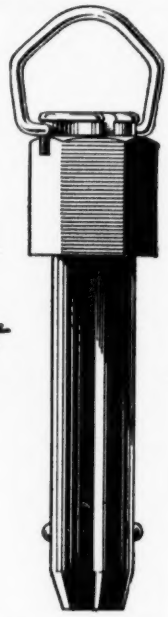
TO QUALIFY: *You should be over 17 and not yet 26 years old, and physically fit. The educational standards required are those of the School Certificate, G.C.E., S.L.C., or equivalent.*

WRITE TODAY for full details of both methods of entry to Admiralty, N.C.W. Branch (EN/71), Queen Anne's Mansions, London, S.W.1.

FLY as a NAVAL OFFICER

PiP POSITIVE SELF LOCKING QUICK RELEASE REGD. (Fully Patented) PiNS

FOR EVERY LOCK PIN APPLICATION WHERE QUICK RELEASE POSITIVE SELF LOCKING IS AN ADVANTAGE



✳ *Adaptability*

The range of sizes is mechanically unlimited. Wherever a locking pin is needed Pip Pins will do the job more quickly—more efficiently—and, in the long run, more economically.

✳ *Simple operation*

Only a simple axial movement is needed to engage or release—the other hand is free to support the member being erected or dismantled.

✳ *Positive Engagement*

Inserting the Pip Quick Release Pin is as simple as pushing home an ordinary pin or bolt—*but once the operating spindle is released the Pin is automatically and positively locked.*

✳ *Self Contained*

The patented internal locking system obviates the need for any further locking device—a great boon under cold, wet conditions or in confined spaces.

AVIATION DEVELOPMENTS LTD.
Kingsbourne House, 229-231, High Holborn, London W.C.1.
Tel.: CHAncery 8601 (8 lines)

SUGG WESTMINSTER

Serves the Industry

THE

Aircraft Division

OF

William Sugg

AND CO., LIMITED

ENGINEERS

RANELAGH WORKS

CHAPTER STREET

WESTMINSTER, S.W.1

Tel VIC 3211

FORGED BLADES FOR GAS TURBINES

BY GARRINGTONS

These blades are precision forged in the new forging shop specially built and specially equipped, with the largest capacity in Europe for the production of forgings for the Aircraft Industry.

The materials forged include

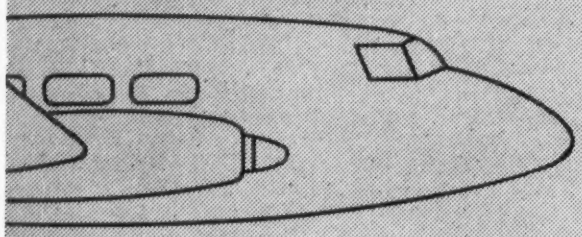
STAINLESS STEELS
ALUMINIUM ALLOYS
ALUMINIUM BRONZES
NICKEL ALLOYS AND
TITANIUM ALLOYS

GKN

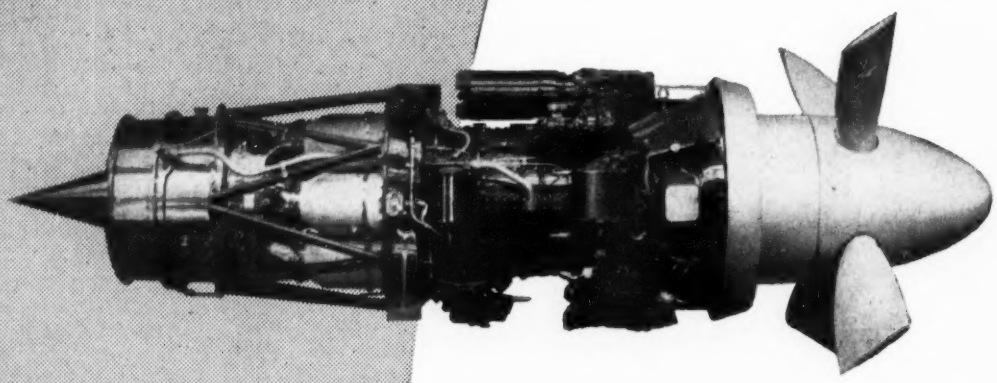
GARRINGTONS LIMITED. BROMSGROVE, WORCS. AND DARLASTON, STAFFS.

Eland

Take off rating 3,000 e.h.p.
Specific weight 0.52 lb/e.h.p.
Specific consumption 0.48 lb/ b.h.p./hr. at 30,000 ft.
350 knots cruising.
Specific consumption 0.452 lb/ b.h.p./hr. at 35,000 ft.
400 knots cruising.



INTER-CITY



NAPIER

Napier have made available to the aircraft industry engines capable of exercising a great influence on the economics of air transport. Illustrated is the Eland propeller turbine, the lightest and most economical in its class.

D. NAPIER AND SON LIMITED LONDON W.3

FLIGHT and AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

No. 2341 Vol. LXIV. FRIDAY, 4 DECEMBER 1953

EDITOR
MAURICE A. SMITH, D.F.C.

ASSISTANT EDITOR
H. F. KING, M.B.E.

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:

DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

Telegrams, Flightpres, Sedist, London.
Telephone, Waterloo 3333 (60 lines).

Branch Offices:

COVENTRY
8-10, Corporation Street.
Telegrams, Autocar, Coventry.
Telephone, Coventry 5210.

BIRMINGHAM, 2
King Edward House,
New Street.
Telegrams, Autopress, Birmingham.
Telephone, Midland 7191 (7 lines).

MANCHESTER, 3
260 Deansgate.
Telegrams, Iliffe, Manchester.
Telephone, Blackfriars 4412 (3 lines).
Deansgate 3595 (2 lines).

GLASGOW, C.2.
26b Renfield Street.
Telegrams, Iliffe, Glasgow.
Telephone, Central 1265 (2 lines).

SUBSCRIPTION RATES
Home and Overseas: Twelve months £3 3s. 0d. U.S.A. and Canada, $10.00.
BY AIR: To Canada and U.S.A., six months, $16.

IN THIS ISSUE:

Canberra Race-Navigation - - 720
Introducing the Bone-box 723
Canadian Navy's Choice 725
High Altitude Cockpit Comfort - - - - - 726
Aircrew at Altitude - 727
Beyond Mach 1 . - - 730
Global Mobility - - - 732
Accessory Drive by Air Turbine - - - - - 736
Fairchild's Airliner - - 738

Full-scale Supersonic Research . . .

IF something is unpleasant an easy remedy is to avoid it. But such action may only amount to putting off the day of reckoning; and, if so, failure to face the facts is the worst possible course to take. We know, for instance, of a timid, small poodle called Puffin who, with no attempt at camouflage, always looks firmly in another direction when confronted with something overwhelming, such as a larger or more formidable dog or cat. There is reason to believe that some people in America are following a similar course in regard to British turbine airliners. But are we in turn "doing a Puffin" over supersonic research aircraft?

On the middle pages of this issue are collected broad details of American progress in supersonic research, and we believe that this evidence of the disquieting practical lead which that country has built up will come as a shock to many. Even those who have read of the developments month by month in our news paragraphs may well be astonished to see the sum total of the progress made.

While newspaper headlines are made in 1953 by an official world speed record of 730 m.p.h., or an altitude record of 63,000ft, we should not overlook the fact that Major C. E. Yeager, U.S.A.F., in the Bell X-1, became the first man to go sonic—on October 14th, 1947; and for this remarkable and still unusual feat he deservedly received an F.A.I. Gold Medal. In 1948 he reached 967 m.p.h. at over 70,000ft and recently an American pilot has flown at 1,327 m.p.h. (see page 719) and another at over 83,000ft. Security may be hiding other equally significant American achievements and discoveries in supersonic flight.

What is the real import of these remarkable performances? Some of the answers are given in the brief review referred to. One reply is that there is no complete substitute for personal experience. Whereas experiments under simulated conditions and with models and wind tunnels *indicate* and sometimes *confirm*, pilots in aircraft *prove*. There is no doubt that, in the coming years, aircraft both military and civil will travel faster and faster beyond the speed of sound and above our atmosphere. The practical knowledge required to design the aircraft (and their control systems) and to build, equip and operate them successfully is being accumulated by America and scarcely at all by ourselves.

Undoubtedly British supersonic aircraft are now on the drawing-boards and even under construction. The country needs not only such machines but, just as urgently, the practical information and experience they will provide.

. . . and its Ramifications

In addition to this week's notes on supersonic aircraft, other features (pages 726-8) draw attention to the problems attending high-speed, high-altitude flight. There are conditions undreamed of by ordinary people: friction-induced temperature-rise of 500 deg or more in air at – 70 deg C; the need to control the composition of the cockpit atmosphere over and above its pressure, humidity, temperature and by the provision of oxygen for the crew; the absence of an accessory-cooling medium (especially for generators and alternators) other than, perhaps, the aircraft liquid fuel—itself suffering from foaming and pressure-feed problems; the need for an entirely new range of hydraulic fluids; protection from solar radiations, "black" light and shadow. Accessories or special equipment and materials must be developed to meet each of these new complications.

We may add that some gas-turbine designers must be wondering why the by-pass engine is regarded as something new, for already the number of accessory demands upon the compressor air are together beginning to amount to a by-pass. Only one per cent of air tapped from the main engine compressor is equivalent to a loss of more than two per cent of thrust. To judge by the lastest developments in de-icing, pressurization, refrigeration and electrics, new turbojets may have to be designed with over-capacity compressors to cater for such auxiliary demands.

Clearly any thought of resting on our laurels—and the industry holds a fair share of them at present—must be very quickly forgotten. Bold action and—let us face this also—heavy expenditure on research will alone keep this country among the leaders. Fortunately, expenditure in the British aircraft industry can fairly be regarded as a sound national investment.

FROM ALL QUARTERS

M.V.O. for Capt. Loraine

WHEN Capt. A. C. Loraine had landed the B.O.A.C. Stratocruiser *Canopus* at Montego Bay, Jamaica, on November 25th, after bringing the Queen and the Duke of Edinburgh from England and Bermuda, Her Majesty went forward to the flight deck and personally appointed him a Member of the Victorian Order (Fourth Class). This honour is conferred in recognition of "extraordinary, important or personal services to the Sovereign or the Royal Family."

Canopus, G-AKGK, had reached Bermuda on November 24th, on schedule from Gander, having flown 1,265 statute miles in 5 hr 25 min. The next stage, 1,273 miles to Montego Bay, was flown between 1000 hr and 1453 hr G.M.T. on the 25th, also exactly on schedule. A photograph of the arrival scene at Bermuda appears on page 742.

The royal travellers are now continuing their world tour in the liner *Gothic;* they are due to begin their next flying stages on December 18th, when they fly over Fiji and from Fiji to Tonga by T. E. A. Solent.

After she had embarked in *Gothic* Her Majesty sent the following message to Sir Miles Thomas, chairman of B.O.A.C.:

"Please give my thanks and congratulations to the Captain and crew of *Canopus* and to all members of your Corporation who helped to make our flight from London to Jamaica so easy and successful."

Last Monday, the *Daily Express* reported that Sir Miles was considering asking permission to re-name the Corporation "Royal British Overseas Airways" after, at a later stage of the tour, the Queen had been flown from Aden to Entebbe and Tobruk; alternatively, it was stated, he might apply for B.O.A.C. to become a royal warrant-holder. The Corporation, on Monday evening, would make no comment on this story.

New Wind-tunnel for A.W.A.

NEWS of the construction of a large supersonic wind-tunnel, at a cost of over £100,000, was announced last week by Armstrong Whitworth Aircraft, Ltd. The tunnel, which is expected to reach completion next year, is powered by a 7,700 h.p. motor and designed for speeds up to Mach 3.

Already in use at Coventry is the company's intermittent-type transonic tunnel, built and put into operation in only six months. Its working-section castings were originally designed for the supersonic tunnel, and for most of the remainder of the tunnel use is made of Weyroc compressed-wood board. Two compressed-air storage bottles of 1,720 cu ft capacity are used in conjunction with a 90 h.p. compressor, the air being fed to the tunnel through four inlet pipes. It is understood that *ad hoc* work on specific problems is the main function of this tunnel.

Before the Wrights

THE majority of references to the Wright Jubilee, including those by *Flight* and various learned societies, have spoken of "the 50th anniversary of powered flight." Although there can be little misunderstanding that powered flight by a heavier-than-air machine is referred to, it does occur to us that the lighter-than-air aspect should be mentioned.

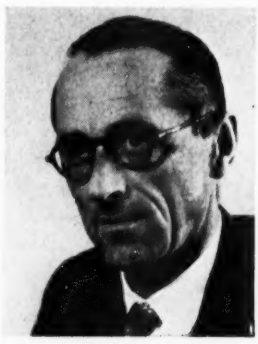
For the record, then, let us remark that on September 24th, 1852, the French engineer Henri Giffard made a successful flight, in an 88,000 cu ft dirigible airship which he had designed and constructed, from Paris to Trappes, a distance of 17 miles. The airship flew, under reasonable control, at a speed of about 5 m.p.h. on the power of a steam engine developing about 3 h.p. for a weight (including boiler) of 350 lb.

Previous dirigible flights had been attempted, but with only qualified success. Two years earlier, for example, Hugh Bell had ascended from Kennington Oval in a 15,000 cu ft airship, the 6ft airscrew of which he operated manually; he drifted down-wind, 30 miles in some 90 minutes.

Also worth recalling at this time is the Russian claim to have antedated the Wrights' success by some 20 years. They credit the honour to an engineer named Mozhaiski, who designed a monoplane and a compound steam-engine said to have produced 30 h.p. for a weight of about 330 lb. Though in recent years the Communists have queered their own pitch by extravagant claims to "firsts" in almost every sphere, this particular example does at least appear to be reasonably well documented. We dealt with it in some detail in *Flight* for July 17th last.

F. H. Pollicutt Joins Percivals

THE firm of Percival Aircraft, Ltd., have long had a reputation for design-originality: the Provost and the Prince/Pembroke, to quote two of their post-war products, are private ventures that have met with general success. News from the Luton firm last week-end, to the effect that Mr. F. H. Pollicutt, F.R.Ae.S., has been appointed chief designer, indicates that the tradition is likely to be more than maintained. He began his new duties last Tuesday, at the head of a design-team under the direction of Mr. L. G. Frise, B.Sc., F.R.Ae.S., A.F.I.A.S., the company's technical director and chief engineer. Frederick Henry Pollicutt was educated at Farnborough Junior Technical School (now Grammar School) and in 1924 was apprenticed to the R.A.E. Six years later he joined the Bristol Aeroplane Co. as a technical assistant and in 1938 he became chief of that company's stress department, thereafter being appointed chief technician (1942), assistant chief designer (1945) and deputy chief designer (1950). Just over a year later he went to Folland Aircraft, Ltd., as chief designer, a post which he has held for the past two years. In his new appointment he rejoins his former chief, for Mr. Frise himself was with Bristols from 1931 to 1948.



F. H. Pollicutt.

Radar Association Extends Activities

ORIGINALLY formed as a social club for ex-R.A.F. radar mechanics and operators, the Radar Association has now extended its activities by the formation of a technical section, membership of which is open to all who are, or who have been, "engaged in the technical or operational fields of radar."

A season of lectures has been arranged, the first of which will take place on Monday next, December 7th. The speaker will be

TWO FANS OVER THE WATER: Reference was made recently to the trials of several new Naval aircraft from the deck of H.M.S. "Eagle." The contra-rotating blades, familiar on Gannets and Wyverns, were joined on this occasion by others in the horizontal plane—on the Bristol 173 (two Leonides). The first landing trials of a 173 on a carrier are depicted in these official Admiralty photographs.

Mr. Arthur C. Clarke, B.Sc., F.R.Ae.S., chairman of the British Interplanetary Society, who will take as his subject *The Exploration of Space*. The lecture will be given in the anatomy theatre of University College, Gower Street, London, W.1.

Other meetings during the season—to all of which non-members are invited—will include lectures on *The Future of Secondary Radar* and *Radar in Meteorology*.

The president of the Radar Association is A.V-M. D. C. T. Bennett, C.B., C.B.E., D.S.O., M.C., F.R.Ae.S., F.R.Met.S., and the chairman is Mr. Raymond Caws. The secretary is Mr. Charles W. Knight, from whom (at the Association's headquarters, 83 Portland Place, London, W.1) details of membership can be obtained.

Air Transport, and How to Sell It

A FORECAST of airliner performance at the centenary of powered flight—in A.D. 2003—was given by Mr. Peter Masefield in a talk at a London luncheon last week. He predicted that passengers would think nothing of supersonic speeds—perhaps of over 2,000 m.p.h.; Glasgow in 40 minutes, New York in two hours, Australia in ten hours—these would be commonplace times. Having made this startling assertion, Mr. Masefield brought it into perspective by reminding his audience that the speed of the Viscount today was that of the world's record only 25 years ago.

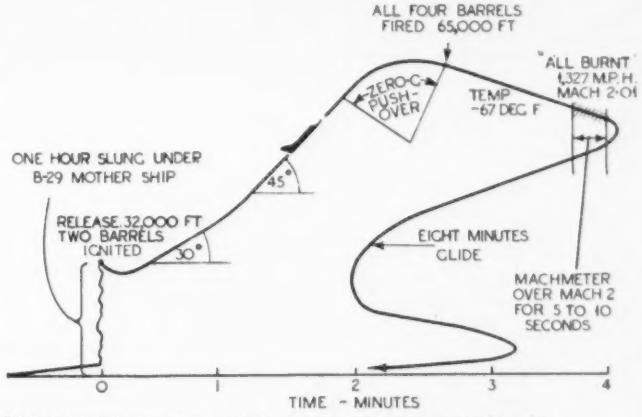
B.E.A.'s chief executive was speaking at one of the periodic luncheons organized by Efficiency Magazine, Ltd., at which leaders in various spheres of industry are invited to speak on their particular business problems. He was introduced by Col. R. A. F. Smith, managing director of the Holland-America Line, with a neat allusion to the medieval custom of "shaking hands with one's executioner and bidding him do his duty."

Designed for a largely non-aeronautical audience, Mr. Masefield's address was a masterly 20-minute summary of the vast field covered by his title—*Getting the Most out of Air Transport*. After an opening in characteristic vein ("you don't *have* to be crazy to get into air transport, but it helps"), he went on to outline the main objectives of an operator: Marketing the best product to meet the public demand; selling it at a profit; producing it economically; and maintaining happy working conditions—a sense of effectiveness—within his organization.

The product sold was the airline seat—"a highly perishable commodity." It had to be quiet, comfortable, safe and offered at the right time; it had to show advantages over other forms of transport. Selling it at a price which the public could afford entailed a realistic rates policy, careful analysis, sound equipment and good forward planning—the operator must try to determine what would be flying ten years from now.

Discussing the "essential tools"—the aircraft—Mr. Masefield went on to examine some basic operational considerations of the kind with which most *Flight* readers are familiar. Of turbine transports he said that Britain had a five-year lead over America—"but we must work hard to keep it."

On the subject of helicopters he was cautious. The type would fill the airline gap for journeys of from 50 to 200 miles, but he thought it was still ten years off for serious commercial operation. There were problems of noise, vibration and metal-fatigue still to be overcome. But the advantages would be unquestionable: on the London-Paris route, for example, it would need a 4,600 m.p.h. fixed-wing aircraft flying from airport to airport to rival the helicopter's time between the two city centres.



SKYROCKETRY: American high-speed research is well covered in this issue; this "Flight" sketch shows the main features of a recent flight by Scott Crossfield with a Douglas Skyrocket, in the course of which he became the first man to travel at twice sonic speed. The flight added only 12 minutes to his log-book, but it consumed three tons of rocket fuel.

Vickers 1000 and the Valiant

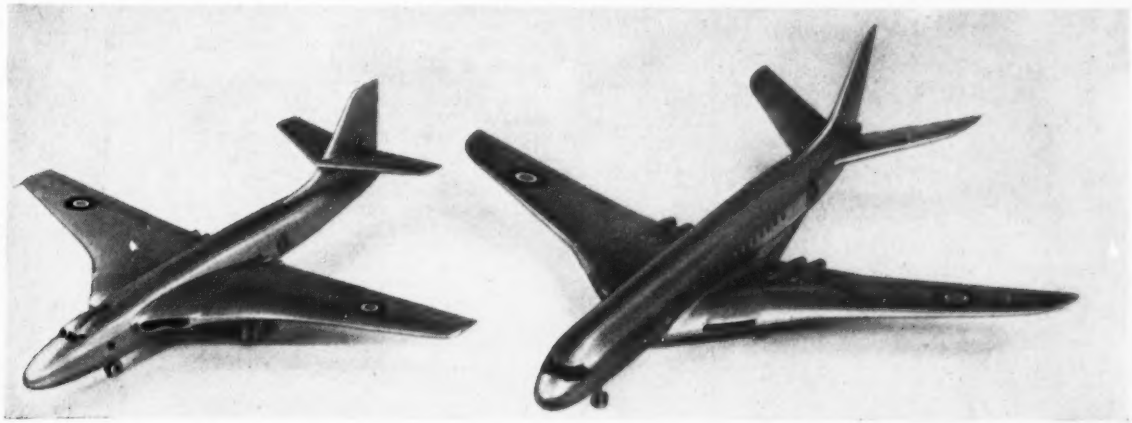
AN impression has got around that the Vickers 1000 and its civil counterpart, the VC-7, are to have main components in common with the Valiant bomber; that these machines will, in fact, be transport derivatives of the Valiant. As may be judged from the accompanying photograph of models of the two transports, to the same scale, this cannot be true, although equally it is apparent that the V-1000 owes something to the Valiant B Mk 1. The makers' original statement, which has perhaps been taken to mean more than was intended, was simply that the wing pattern of the V-1000 is somewhat similar to that of the Valiant. Comparative plan-form illustrations of the "1000" and the Valiant appear on page 729 of this issue.

Instructions were received in January last to proceed with the construction of a Vickers 1000 prototype for the R.A.F. It may be recalled that the span was stated to be about 140ft, the length 146ft and the height 38ft 6in. The four turbojets specified are to be Rolls-Royce Conways, although it seems possible that the prototype will make its first flights on Avon power. "High subsonic speeds over long ranges" is the only official mention of performance so far.

It is understood that large, recognizable components are now to be seen in the Vickers factories as witness of hard work since construction began early in the year.

The civil VC-7 is designed for a seating layout for 100-150 passengers, and by virtue of its by-pass turbojets it is expected to be more flexible in operation than earlier pure-jet machines. Both B.O.A.C. and B.E.A. are interested. No announcement has been made regarding a production order for the Vickers 1000, but there is no doubt that the military authorities are now well aware of the need for global mobility and that the best and most economical way of achieving it is by air transport.

FAMILY LIKENESS: Similarly-scaled models of the Valiant B.1 and the Type 1,000 prototype. The big-fuselage family of transports will enjoy extreme flexibility of operation, conferred by such features as unusually economical engines (to be Rolls-Royce Conways in production machines) and an unobstructed cargo-floor area of some thousand square feet. A plan-view comparison appears on page 729.



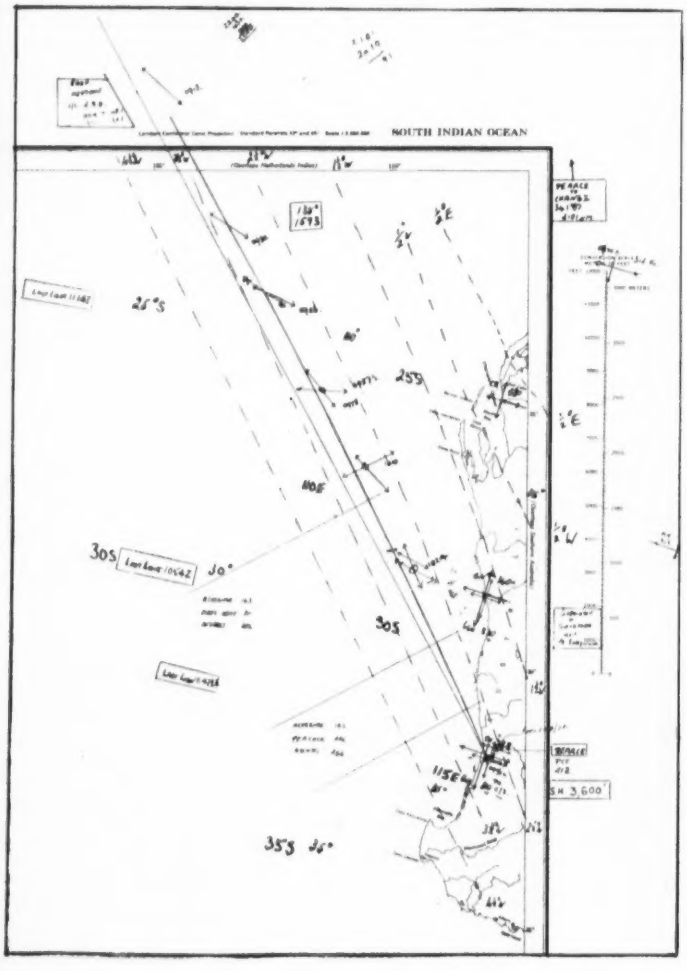
CANBERRA RACE - NAVIGATION

Crew-Members Describe Methods Used During the London-Christchurch Contest

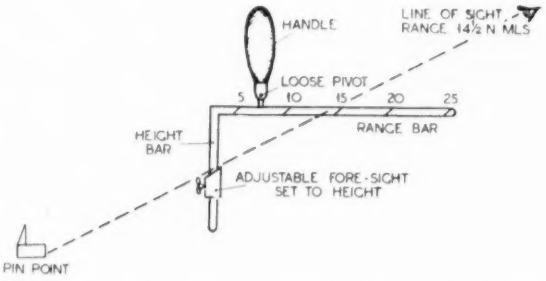
AS briefly reported in *Flight* last week, three members of the R.A.F. New Zealand Race Flight described some of their experiences to the Institute of Navigation on November 20th. The speakers were the crew of the Canberra PR.7—W/C. L. M. Hodges, D.S.O., D.F.C., leader of the Flight, and S/L. R. Currie, A.F.C., chief navigator—and the pilot of the winning Canberra, F/L. R. L. E. Burton, A.F.C. There follows a condensed summary of their papers.

S/L. Currie explained that complicated techniques, such as grid navigation, were "out" from the start. There was insufficient opportunity to practise such methods, and the aircraft were in any case to be manned by what he modestly termed ordinary R.A.F. navigators. The great-circle route to Christchurch (10,600 n.m., unless one could save 400 n.m. by flying *via* Russia) was broken down into rhumb-line sections every 10 deg of longitude, which added only 37½ n.m. Small-scale plotting maps, essential to keep down the amount of paper in the cockpit, were obtained from the U.S.A.F., as the new R.A.F. 1 : 3 m series does not yet give full coverage for New Zealand.

Since the R.A.F. Canberras—unlike the Australian machines—had autopilots and were thus able to be operated by a two-man crew, fuel control became the navigators' responsibility. They used a simple chart on which air miles were plotted against fuel, with bands for different heights and Mach values. By the "howgozit" method, it was thus possible to see if the amount of fuel remaining permitted an increase of speed—by increasing Mach or shedding height—at some cost in fuel consumption.



A portion of the plotting chart—showing the second half of the Ceylon-Perth leg—used by S/L. Currie during the New Zealand Race.



S/L. Currie's sketch shows the "dangleometer," devised by W/C. Anderson to facilitate assessment of distances at high altitude.

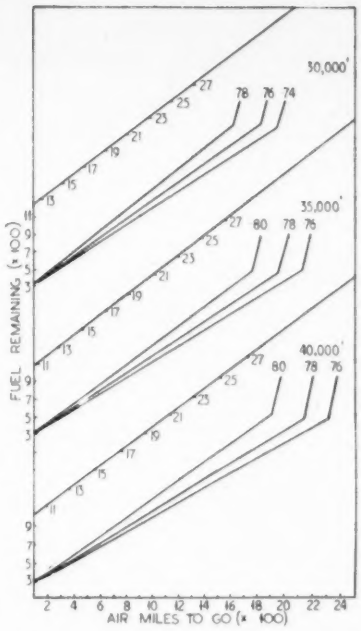
For the race, the Canberras were fitted with the Marconi AD.7092 radio-compass, and Rebecca for fixing descent-points; the normal Gee equipment was removed. The air-position indicator was retained, and an air-mileage indicator added. Each aircraft carried two V.H.F. sets (one using the standard canopy aerials and the other connected to a spike aerial under the fuselage) and two compasses—Sperry Gyrosyn and Kelvin and Hughes E.2 magnetic. For astro, the main standby, and for sun-shots over the Indian Ocean, navigators used the Kelvin and Hughes R.A.F. periscopic sextant modified for R.A.F. use.

An additional aid, devised by W/C. Anderson, Bomber Command navigational officer, was the "dangleometer"—a simple but effective way of estimating distances at high altitude. It consists simply of a right-angled piece of metal suspended loosely from a handle. On the vertical scale, graduated in thousands of feet, is a movable foresight which the pilot aims at a chosen pinpoint; the horizontal scale is graduated in miles, and the distance of the object is the point at which the line of sight is estimated to intersect this scale.

Radio serviceability was good, and although night effect was troublesome, practice flights had enabled crews to be prepared for it. It proved possible to get bearings from a 500W beacon at 300 n.m., and from 10kW beacons at 800 n.m.; they were audible at respective ranges of 500 and 1,000 n.m. Angle-off bearings with the radio compass were sometimes useful for deciding the descent-point. Average Rebecca range was 60-70 n.m. in Europe and 90 n.m.—sometimes up to the full distance of 120 n.m.—elsewhere. The periscopic sextant gave 15 n.m. accuracy with a single position-line when the cruising attitude was established; readings during the settle-down period were so inaccurate as to be immediately obvious. The air-mileage unit was found during training to produce large and inconsistent errors; it turned out to be drawing in hot air, instead of cooling air and, after modification, worked to a mean error of less than one per cent. By dispensing with automatic volume-control, V.H.F. range could be increased from 200 to 250-300 n.m.

Extra facilities provided for the race crews included beacons in Yugoslavia and Turkey; on-track transmissions from a Naval tanker between the Persian Gulf and Colombo; Australian M.F. beacons; V.H.F./D.F., M.F. beacon and search radar from the Australian carrier *Vengeance* half-way across the Tasman Sea; radio aid from the N.Z. destroyer *Lachlan*, 200 n.m. from the New Zealand coast; weather broadcasts by the New Zealand radio stations; and Eureka at Cocos, Perth and Christchurch.

W/C. Hodges mentioned further assistance from R.A.F. Washingtons patrolling over the Arabian Sea. From the PR.7 (which, it will be remembered, carried sufficient fuel to cross the Indian Ocean direct from Ceylon to Perth) he had a clear view of the Cocos Islands as he flew past 20 miles to the south. During this leg the port generator failed but was re-started; the starboard generator then failed, and with the other unit suspect an inspection



(Right) A cruise-control chart of the type used by R.A.F. Canberra crews. The Mach-number and consumption values shown are hypothetical.

was essential. Delay in the work of repair put the favourite out of the running.

Before the race there had been doubts as to the crews' ability to withstand fatigue under such conditions, but training and physical fitness had removed the difficulties from flying almost continuously for 24-30 hr. With future jet bombers it might be an everyday thing.

F/L. Burton, discussing the final part of his journey, mentioned a *contretemps* with a civil aircraft at Perth, which, he said, had been exaggerated by reports. There was laughter when he explained that the other aircraft was landing when the Canberra took off, but decided to go round again with the jet bomber climbing away underneath it. There was very little V.H.F./D.F. over Australia, but he was in any case reluctant to give away his position (he had heard S/L. Raw landing at Woomera but did not know whether he had taken off again). *Vengeance* gave Burton's Canberra some good position lines during the Tasman crossing and the British pilot also contacted a Qantas skipper who had used the Christchurch G.C.A. three days earlier. It was good to receive this timely briefing "straight from the horse's mouth." Approaching Christchurch just before dawn, Burton picked up his destination 200 n m. out on V.H.F. and was thereafter under radar control. He arrived overhead at 7,000ft and touched down to win seven minutes later. Raw (who landed 5-10 minutes after Furze, but drew second place after adjustment for starting interval) reached Christchurch with V.H.F. out of action. He flew out to sea, descended to 400ft and crawled in—"a very fine effort," remarked F/L. Burton.

Summing up from the navigators' viewpoint, S/L. Currie said that they found the choice of time for the race unhelpful—it involved long night-stages over land with no moon and maximum night effect, and overwater stretches in daylight. Despite a warning from the New Zealand Hastings crew, they found that night effect over Australia was not as bad as over Europe; the needles were swinging, but it was possible to get a mean bearing.

In reply to a question, W/C. Hodges said that tip tanks, unless dropped, would not have been any real advantage; 300 of the additional 500 gal would have been used in overcoming their drag at high cruising speed. S/L. Currie, answering another question, said that he had not encountered any jet-streams. The broad, high wind encountered over Australia had in fact been 20 kt below the forecast 70 kt. Nobody had been affected by icing, and the highest cloud *en route* had been cirrus at 35-40,000ft on the Ceylon-Cocos stage. On the subject of differences between R.A.A.F. and R.A.F. navigational technique, W/C. Hodges said that it was interesting to note that total in-flight time for all five Canberras varied by no more than 7 min. The number of refuelling points on the aircraft was a vital factor governing turn-round times: the Australian Canberras had five, compared with nine on the R.A.F.'s PR.3s and 13 on the PR.7.

CANBERRA RECORDS

DURING the race, R.A.F. crews set up three new point-to-point records, which have now been officially confirmed by the F.A.I.—London-Basra, London-Colombo and London-Christchurch. In addition to the ten course records tabulated below, the world altitude record (aeroplanes) was also established in a Canberra—an Olympus-powered version flown by W/C. W. F. Gibb, who reached a height of 63,668ft on May 4th, 1953.

Date	Route	Distance (st. miles)	Time hr min	Speed (m.p.h.)	Canberra Mk	Crew
31.8.51	Aldergrove-Gander	2,072	4 18	483.9	B.2	Beamont, Watson, Rylands
18.2.52	London-Idris	1,459.8	2 41	541.26	B.2	De Vigne, Hunt
26.8.52	Aldergrove-Gander	2,072	4 33	454.89	B.2	Beamont, Watson, Hillwood
26.8.52	Gander-Aldergrove	2,072	3 25	605.52	B.2	Beamont, Watson, Hillwood
28.9.52	London-Nairobi	4,246	9 55	427.3	B.2	Connolly, Clare, Sir H. Lloyd
27.1.53	London-Karachi	3,921	8 52	441.8	PR.3	Whittington, Brown
27-8.1.53	London-Darwin	8,608	22 0	391	PR.3	Whittington, Brown
8.10.53	London-Basra	2,832	5 12	543.9	PR.3	Burton, Gannon
8-9.10.53	London-Christchurch	11,796	23 51	494.6	PR.3	Burton, Gannon
8-9.10.53	London-Colombo	5,416	10 25	519.5	PR.7	Hodges, Currie

THE JUBILEE: CULMINATING EVENTS

WITHIN the next fortnight the celebrations of the 50th anniversary of powered flight—which falls on December 17th—will reach their climax on both sides of the Atlantic.

One of the final events in America's commemorative programme will be the delivery, on that day, of the Wright Brothers Lecture, sponsored by the Institute of the Aeronautical Sciences. The lecturer will be Mr. Glenn L. Martin, and his subject will be *The First Half-Century of Flight in America.*

Among British celebrations of the anniversary there will be the joint R.Ae.S.-R.Ae.C. dinner on December 17th—referred to in our pages last week—and a lecture under the auspices of the Royal Society of Arts, where Capt. J. Laurence Pritchard, C.B.E., Hon. F.R.Ae.S. (late secretary of the R.Ae.S.) will speak on the work of the Wright brothers; this lecture will be given at 2.30 p.m. on Wednesday, December 16th.

On Monday, December 14th, the Director and senior staff of the Royal Aircraft Establishment are holding a celebration dinner at Farnborough, to which a number of men associated with the earliest days of aviation have been invited.

The historic Blackburn monoplane of 1912 and the famous B.2 trainer will be included in an exhibition which Blackburn and General Aircraft, Ltd., are arranging in Hull; and on December 21st the Brough Branch of the R.Ae.S. is to hold a commemorative dinner at the Guildhall, Hull. It is hoped that the speakers will include Sir William Farren, C.B., M.B.E., M.A., F.R.S., M.I.Mech.E., F.R.Ae.S. (president of the R.Ae.S.), Mr. Robert Blackburn, O.B.E., A.M.I.C.E., Hon. F.R.Ae.S., and Mr. Eric Turner (managing director of Blackburn Aircraft). The Shell film *The Story of the Century*—which will have had its *première* at the R.Ae.S.-R.Ae.C. dinner—will also be shown. A number of other R.Ae.S. branches are also holding celebrations.

The Science Museum, South Kensington, is arranging a special exhibition, the theme of which will be the historical aeronautical events which culminated in the Wright brothers' flight. Mr. P. Sumner, B.Sc., A.R.Ae.S., A.M.I.Mech.E., who is in charge of the National Aeronautical Collection, has collated manuscripts, drawings and photographs which tell the story of man's ambition to fly, beginning with references in ancient mythology and leading up through the work of the great theorists and experimentalists of the middle ages to the achievement of lighter-than-air flight and eventually to the momentous event at Kitty Hawk. The R.Ae.S., R.Ae.C. and the National Museum at Washington are among the organizations that have contributed material to the exhibition, which will open on December 15th and is likely to remain open (at the usual Science Museum hours) for some three months.

CATCHING THEM YOUNG

On Thursday, January 7th, the Royal Aeronautical Society will be reviving a custom which has been in desuetude for many years—in fact, since well before the last war. A distinguished lecturer, in this case Sir Leonard Bairstow, C.B.E., F.R.S., Hon.F.R.Ae.S., vice-chairman of the Aeronautical Research Council, is to deliver a "young people's lecture." His talk, entitled *The Fun of Finding out in Flying* and illustrated by slides and models, will be given at 3 p.m. at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1. Tickets—for which there is no charge—may be obtained from the R.Ae.S. at 4 Hamilton Place, London, W.1.

HERE AND THERE

REPEAT ORDER: Following an earlier order for 54 ex-R.A.F. Lancasters, another five have been converted by their makers and sold to the French Government for patrol duties and civil air/sea rescue work by naval crews. In this photograph taken during collection at Ringway are (left to right) 2nd Maitre B. L. Clement, Maitre F. A. Deschamp, Officier des Equipages H. A. Mechineau (pilot), Capitane F. E. Siaud, Mr. E. Galitzine (Avro sales), Officier des Equipages V. J. Ostrowski (co-pilot) and Maitre J. L. Geat.

Royal Heliport?

IT is reported—though without confirmation from official sources—that the Duke of Edinburgh has asked that a landing-ground be found, near the centre of London, from which he may fly by helicopter to keep official appointments in South-Eastern England.

Normandy Air Base

AT a cost equivalent to some £3 million sterling, the French Air Ministry intends to build an air base at Lessay, on the marshy moorlands of the Normandy peninsula. It will have a 4,000-yard main runway.

A Helicopter Christened

THE chairman's statement issued in advance of the Westland annual general meeting (to take place on December 16th) reveals that the name chosen for the Service W.S. 55 is Whirlwind. The same name, it may be remembered, distinguished a Westland twin-engined, single-seat fighter of the early war years.

All-rounder

AFTER joining the A.T.C. at 13½, learning to glide, gaining his P.P.L. at 17 under the A.T.C. flying scholarship scheme and becoming a cadet pilot officer in the R.A.F.V.R. about a year later, 20-year-old Dudley Bottoms gains another distinction: at the apprentice prize-giving of Hoover, Ltd., last week he was awarded the works manager's shield as the most outstanding apprentice of the year.

And No Go Bak?

LT. NO KUM-SOK, the North Korean pilot who delivered a Mig-15 to the United Nations two months ago, is to receive his £35,000 reward.

Photographic

TO all who are interested in photography, or who seek a Christmas gift for others so inclined, we commend *Photograms of the Year 1954*. Published for *Amateur Photographer*, this is the 59th consecutive edition of a masterly review of the world's finest photographic work; it is now available, price 12s 6d, from booksellers and photographic dealers. Also of particular value to camera enthusiasts will be the Christmas Number of *Amateur Photographer*, appearing on December 9th; among its special features are suggestions for photographic-equipment gifts.

Corridor Talks Resumed

AFTER a break of eleven weeks, the Four-Powered Conference on the Berlin air-corridor safety was resumed with a meeting on November 21st. There are indications that two or three further meetings may bring a settlement. The discussions were a sequel to the shooting-down of a Lincoln by Soviet fighters last February.

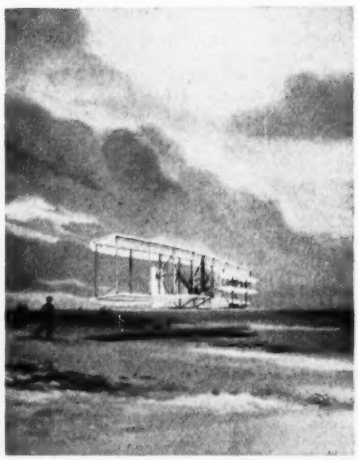
Exports Up Again

THE value of aircraft and parts (including tyre outer covers) exported from Great Britain during October totalled £5,393,018, compared with £4,041,588 in the same month last year. This brings the total for the year to date to £54,343,461, as against £36,084,140 in the corresponding period last year.

ON THE HOMEWARD FLIGHT after the New Zealand Race, two of the R.A.F. Canberras were joined by a third from England, and gave demonstrations and flights at Bangkok, Rangoon, Delhi and Karachi. This picture, taken at Delhi, shows Pandit Nehru, Prime Minister of India, with W/C L. M. Hodges, leader of the R.A.F. team

"FLIGHT" NEXT WEEK

OUR next week's issue will commemorate the Wright Jubilee. A greatly enlarged special number, it will contain a unique review, both in scope and in its numerous illustrations, of the development of heavier-than-air flight since 1903.



THE WRIGHT BROTHERS' FLIGHT, as portrayed by C. Rupert Moore, A.R.C.A., in a special painting for the Science Museum exhibition referred to on p. 721. Having studied all available data, the artist constructed a scale model from which he prepared the picture.

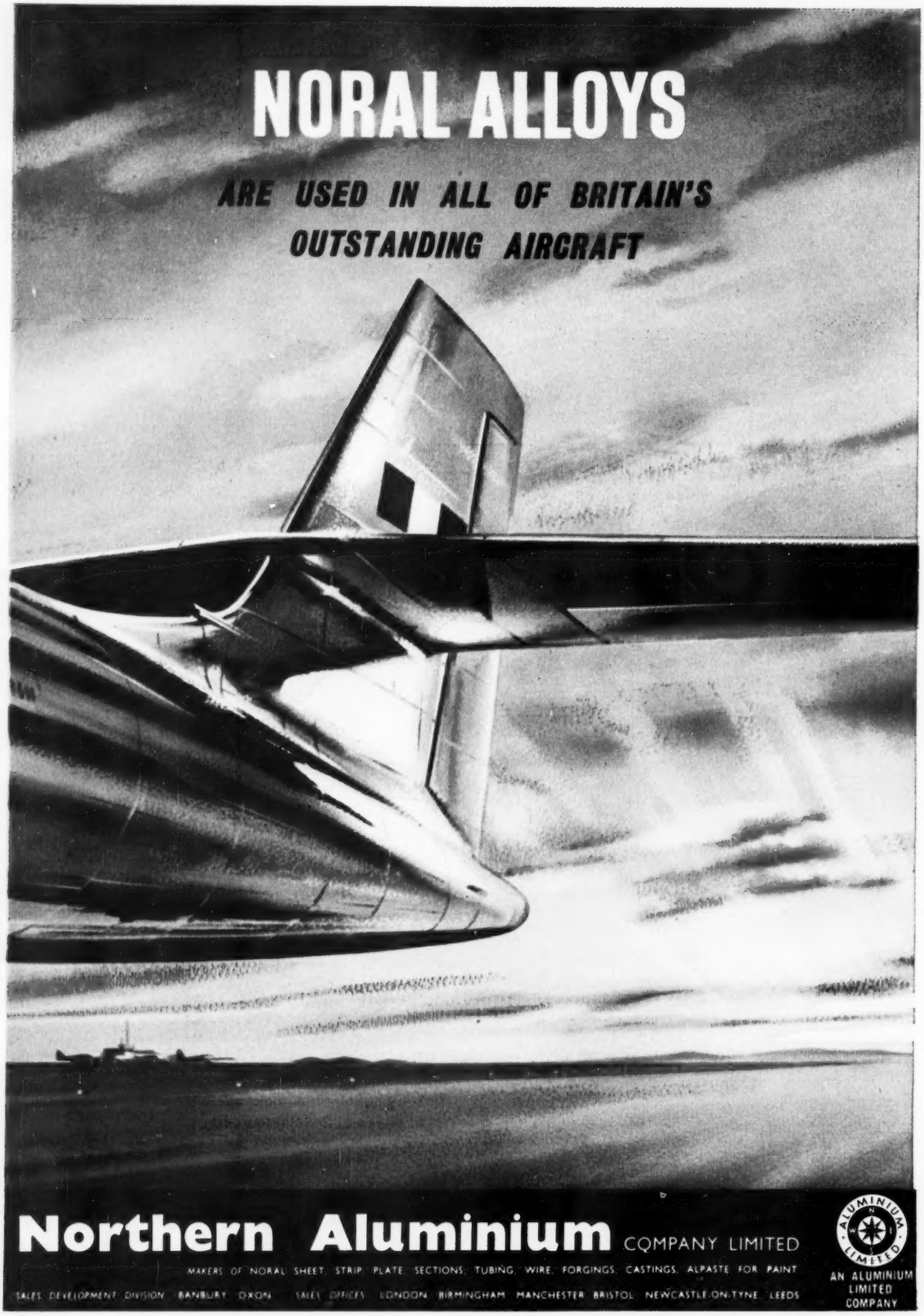
Mercy Service

THE 25th anniversary of the founding of Australia's Flying Doctor Service is being celebrated in Adelaide by an appeal in aid of the establishment—at Port Augusta, South Australia—of a tenth base. Over 850 outback homesteads are served by the existing nine stations.

New Basis for B.I.F.

NEGOTIATIONS are in hand for the London sections of the British Industries Fair to be organised—probably from 1955 onwards—by a new private corporation; the Birmingham section is to continue in the care of that city's Chamber of Commerce. A White Paper published last week suggests the Crystal Palace as a new site for the London Fair.

FAIREY
GANNET
THE FAIREY AVIATION COMPANY LTD · HAYES · MIDDLESEX · ENGLAND


NORAL ALLOYS
ARE USED IN ALL OF BRITAIN'S
OUTSTANDING AIRCRAFT
Northern Aluminium COMPANY LIMITED
MAKERS OF NORAL SHEET, STRIP, PLATE, SECTIONS, TUBING, WIRE, FORGINGS, CASTINGS, ALPASTE FOR PAINT
SALES DEVELOPMENT DIVISION BANBURY OXON SALES OFFICES LONDON BIRMINGHAM MANCHESTER BRISTOL NEWCASTLE-ON-TYNE LEEDS
ALUMINIUM LIMITED
AN ALUMINIUM LIMITED COMPANY

INTRODUCING THE BONE-BOX

The Crash Helmet Reaches the R.A.F.: Its Purpose and Capabilities

The new R.A.F. headgear now being worn by 2nd T.A.F. Sabre pilots. The mask is the American A13A with a British microphone; the visor, of purely anti-glare type, is not a standard fitting.

THE American Lombard anti-buffet flying helmet, when it first appeared regularly in photographs and later "on the flesh" in Europe, received a mixed reception. People either approved or condemned the space-man appearance it conferred on its wearer; some of them thought either that it was too heavy for the wearer's neck under high g loads, or that it restricted his field of vision, or even that it was an over-elaborate device to prevent injury in the comparatively rare case of a crash landing. But the U.S.A.F. had found that it could save a pilot's head from serious injury in a crash landing, and for this reason issued the helmet as a reasonable safety precaution. Only a few cases of such escapes were needed to convince the U.S.A.F. of its value. Another factor may have been that the canopy of early F-80s was so small that the pilot often bumped his head on it taxying on rough ground or flying in bumpy weather. Other factors were the helmet's function as a "solar topee" at altitude and the protection it afforded when the possible need later arose of ejection through the canopy.

An anti-buffet helmet of British design and manufacture is, however, now being issued to R.A.F. squadrons (particularly those operating Sabres in 2nd T.A.F. in Germany), and also to the Fleet Air Arm, and the philosophy behind the original introduction of the "bone-box," as it is known in 2nd T.A.F., has finally been accepted. Considerable effort is now being devoted to the design and it has now become obvious that a critical point in the sequence of ejection at high speed is the first violent contact of the airman's face with high-speed airstream on leaving the protection of the windscreen. Some idea of the magnitude of this part of the problem alone can be gained from the fact that a sudden exposure to an airstream of, say, 400 kt is equivalent to meeting at close range the blast impact of a medium-sized bomb. Apart from this, there is the necessity of providing some form of protection for the airman's head in case he has to attempt ejection through the canopy, or if the seat is fired accidentally with similar results.

The introduction of the R.A.F. and F.A.A. "bone-box" did not closely follow this line of thought, however: it was the result of several different post-war Service requirements which were at various times made known to the manufacturers and subsequently combined to form the headgear illustrated on this page. The company responsible for its development, in conjunction with the Institute of Aviation Medicine, is Helmets, Ltd., of Wheathampstead, Herts. This firm has, since 1924, been engaged on the manufacture of protective headgear, first for racing motorists and motor-cyclists, and then for firemen, miners, welders and many others whose heads are exposed in the line of duty. After the war Helmets, Ltd., began to experiment with new materials and processes in an effort to overcome the limitations of some of the materials previously used. Research led to combinations of wood-pulp and resin, and finally to cotton laminates, which proved to have double the strength of the former. Then, in May 1951, the company was asked by the M.o.S. to develop a new aircrew-helmet incorporating new I.A.M.-developed sound-excluding ear-pads. The object was, by reducing weight and bulk, to produce a light, compact, cool and washable cloth helmet. Wiring, ear-pads, and earphones were easily removable from the cloth helmet, the intention being to issue one set of wires, phones and pads and two helmets to each aircrew-member, so that one helmet could be sent to the laundry when necessary. The arrangement of wiring and plugs, pads and earphones was very carefully designed to make the whole set easy to dismantle and yet easy to put together with the minimum risk of faulty assembly. Every effort was made to prevent wires and plugs from being pressed against sensitive parts of the head. In each of the four sizes to be produced provision was made for adjustment and helmet-fit by lacing at the base of the neck, and for the covering and stowing of the "Y" junction of leads at that point. The ear-pads were large and close-fitting, and the earphones inside them were very small and light; earphone terminals were simple plugs inserted in the phone and held by a grub screw.

This helmet would have proved a considerable advance over previous equipment, but before it was generally issued, a new requirement was passed on by the F.A.A. This was for a headgear to protect pilots' heads during crash landings on aircraft carriers. To this requirement Helmets, Ltd., designed a protective shell which would fit over the new cloth helmet. The cloth helmet, in fact, became the phone- and mask-carrying part of the new combination, since its light, flat earphones and cool, soft cloth material made it ideally suited for this purpose. The rigid shell was originally designed merely to fit over the soft helmet without any fastening, but it was subsequently found that, when exposed to an airstream of 120 kt, it began to rise off the head due to the lift generated over its upper surface. A chin-strap was therefore incorporated.

In 1952, however, the R.A.F. issued a requirement for a head-gear designed to afford more than just crash impact protection. It had to protect a pilot during ejection from the Sabre (these were expected shortly in service with 2nd T.A.F.) whose ejection seat is trigger-fired from the seat armrest and has no face-protection blind. Ideally, this requires complete face- and head-protection from blast effect with the very minimum of weight, to alleviate so far as possible the downward jerk of the unsupported head as the ejection-charges fire.

The equipment which has now gone into service with 2nd T.A.F. consists of the new type "F" inner cloth helmet with the U.S.A.F. A13A pressure-breathing face mask, modified for R.A.F. use, and covered by the Helmets, Ltd., anti-buffet "shell" with chin-strap. A similar combination, but fitted with an English mask, is to be issued to the F.A.A. Further production will be for Sabres and other aircraft either already in service or due to reach squadrons soon. By next June, Helmets, Ltd., hope to produce about 2,000 sets.

Being completely detachable from the remainder of the helmet set, the protective shell can be described separately. It has been developed by Helmets, Ltd., to meet the functional requirements laid down by I.A.M. It consists of a moulded phenolic-resin-impregnated nylon shell (the subject of a patent application) lined with leather, with forehead and side pads of rubber and fitted with a nylon-tape cradle specially arranged so that it will not interfere with the ear-pads of the inner helmet. The shell is kept ¼in clear of the head by the cradle and the forehead pad. Slight bulges at the sides accommodate the sound-excluding pads of the inner helmet and also provide a certain aerodynamic adhesive effect when the aircraft hood is open at speeds of up to 120 kt. The complete shell weighs 24 oz, and is made in four sizes with two head-widths per size. The lower extremities of the shell about the "lobes" over the ears are moderately flexible, thus providing additional shock-absorption and comfortable fitting. The strength of the shell is remarkable. A round-ended 8 lb weight dropped from a height of 5ft will hardly mark it; a hefty blow with a hammer is equally ineffective. It takes about 100 blows of this kind before damage appears, and this then takes the form of vague cracks and de-laminations. No dangerous splinters at all result, since the resin merely flakes. The shell is built of four nylon bag-like sleeves slipped over a mould and individually sprayed with resin, with four nylon reinforcing inserts interspersed, the whole being subsequently cooked, trimmed and finally "furnished."

The purpose of the shell is: (1) to provide protection against shock impact, and (2) buffeting; (3) to protect the pilot's head during ejection through the canopy (or in case the canopy, on

INTRODUCING THE BONE-BOX . . .

jettisoning, comes away sideways across the cockpit); and (4) by its silver-dope finish to reflect the heat of direct sunlight at high altitude.

For these purposes the present helmets appear to be quite adequate. However, the problem must arise of blast protection for the face during ejection in a seat not provided with a face-blind. In the case of the American seat, which is of this type, photographs show that the pilot's head is fairly violently jerked downwards and forwards by the shock and by the weight of his headgear. Whereas this may be injurious to the neck it does place the head and helmet in the best position to resist the violence of the airstream. Even the later U.S.A.F. ejection seats are not fitted with a face-blind, and it is probably considered more important that the pilot should have the firing mechanism close to hand than that his face be protected by a blind. This opinion is shared by many pilots. A face-blind, on the other hand, will undoubtedly give adequate protection during ejection up to a speed of 400 kt. A U.S. Navy F9F-6 Cougar pilot successfully ejected through the canopy at between 25,000 and 32,000ft at an indicated speed of about 400 kt (a true air speed of about 600 kt, equalling approximately 0.95 Mach); he was wearing a crash helmet and his seat had a face-blind. For the Sabre seat, however, some form of protective visor is under development by Helmets, Ltd. The visor illustrated is for sun glare—it is normally made of coloured plastic—and is not designed to resist a high-speed airstream (i.e., at above 180 kt). In any case, a visor which is not designed in conjunction with the face mask provides little protection: the mask is pressed flat against the face and air is let in under the lower edge of the visor, so that the helmet would then be torn off the head.

Even if the head is satisfactorily protected against violent blast-impact it is probable that other parts of the body would be injured. Furthermore, the ejected airman, though he may not be seriously hurt during ejection, may be rendered unconscious and thus not be able to carry out the remaining vital actions for opening his parachute. Automatic parachute-opening appears to be essential, and is in fact employed on all new ejector seats. Old-type seats are being modified.

A further aspect of crash-helmet construction bears consideration. When the shell is strong enough to protect the skull from damage by a very heavy and concentrated impact the shock is mere.y transmitted to the neck, causing a rupture at this point.

In conclusion, it may be said that though the new helmets are most encouraging and efficient for the four purposes stated above, no completely effective solution to the general problem of really high-speed ejection has yet been devised. This present contribution to safety and operational efficiency, however, is already a considerable step towards pilot protection, not to say pilot morale.

HEAD-PIECE TAILPIECE

Methods of testing helmets, as well as of designing them, have progressed a long way since 1912, when this "Flight" photograph was taken.

TO KEEP THE RECORD STRAIGHT

FREQUENTLY we feel an urge to correct inaccurate American statements about British aviation matters, and there are occasions when, on reflection, we consider ourselves justified in doing so in print. This can perhaps be regarded as one duty of a journal such as *Flight*—in justice to the British companies or individuals concerned and to keep the record straight. As often as not, unfortunately, the harm is done before anyone can intervene; and there are plenty of occasions when the mis-statement is apparently intentional or where the individual does not wish to know the truth.

Some misleading pronouncements by responsible people are difficult to explain. For example, how can Mr. C. W. LaPierre, manager of the gas-turbine division of the American General Electric Company, have come to re-write gas turbine history in the course of a recent article he prepared for *Aviation Age*? By virtue of his position he surely has a full knowledge of gas-turbine background, yet he writes (the italics are ours):—

"It was the Whittle engine that spurred this country to action, and the first American jets flew in a Bell P-59 almost eleven years ago [October 1942—Ed.]. The life of all early jets was discouragingly short. *Many British designers began to see a ceiling on thrust at around 2,000 lb until this country's* 140, *or* J33, *went on test at 4,000 lb.* America had made her first major contribution in the new field and broken another imaginary barrier set up by the minds of men."

All this sounds very fine, but we feel that it is overlooking an important point to suggest that "the Whittle engine spurred (America) to action." So far as the Allies were concerned, the gas turbine was developed into a usable aircraft power-plant solely by Frank Whittle, assisted by a small band of loyal engineers working on a ridiculously small budget. Having produced an engine cleared for flight, this country handed Mr. LaPierre's company an example on a plate, together with all the working drawings and with three of Power Jets' specialists thrown in for good measure.

All this was in September, 1941, before America entered the war. Before Pearl Harbour the General Electric Company had decided to build the Whittle W.2B turbojet, modified to take American accessories. This British engine, styled General Electric I-16, made possible the Bell P-59. We may also recall, incidentally, that it was the de Havilland H-1 engine which (in January 1944) first took aloft the excellent Lockheed XP-80, forerunner of a line of fighters and trainers still in full production.

What about this "2,000 lb ceiling on thrust" contention? Mr. LaPierre's I-40 was designed to give 3,000 lb thrust in the first instance, but increased knowledge led to bolder targets, and the design begun in June 1943 was intended to provide a thrust of 4,000 lb. This performance was reached in the spring of 1944, and the first flight took place in the XP-80A on June 10th, 1944, four days after D-day.

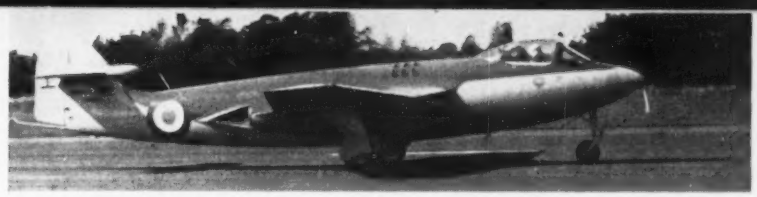
But we had not been quite static in England. Major Halford's H-1, still in production as the Goblin, was designed to give 3,000 lb thrust—and it was designed for this thrust in April 1941 (before America had heard of the turbojet). This thrust was reached in the summer of 1942, and in the following year the Goblin was in the air, both in the Meteor and Vampire. (Mr. LaPierre's I-40 did not fly until a year later.) By 1943 the first Metrovick axials were flying, and their design ratings varied up to 3,500 lb. In November 1943 the first Rolls-Royce unit—the W.2B/26, taken over from Rovers—had passed a 100-hr type test at 2,000 lb, and development went steadily up to 4,200 lb thrust, which brought us the world speed record immediately after the war. During 1944 the first Nene ran, first at 4,000 and later at 5,000 lb thrust. And, right back in 1943, Armstrong Siddeley were running the A.S.X. axial turbojet at far over 2,000 lb thrust, even though this engine was solely a development unit to pave the way for the Python.

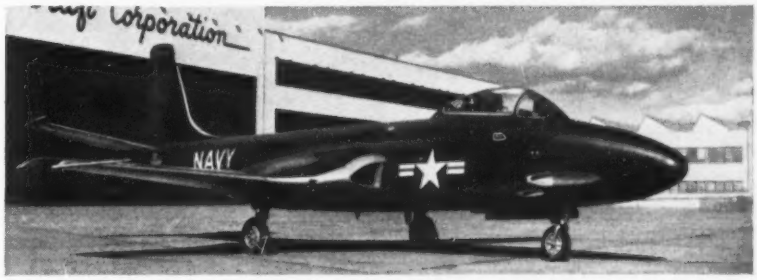
The foregoing information is offered, as we have said, in order that the record may be kept straight. Mr. LaPierre, no doubt, was simply not informed of what was going on outside America.

FORECASTS FOR 2000 A.D.

THERE are obvious possibilities for speculation on aeronautical matters in the bicentenary competition organized by the Royal Society of Arts, as the subject set is *The Practical Aspects of Life on this Earth in the Year 2000*. The Society has chosen the year 2000 "because, while a period of 46 years would allow for the origination and development of entirely new features of life, it is short enough to enable competitors to envisage the world as they or their sons or daughters would like to see it."

The competition is open to (*a*) persons of British nationality and (*b*) Fellows and Associates of the Royal Society of Arts of whatever nationality. Entries may be in written or visual (i.e., drawings or models) form. Awards of £250, £100 and £50, with ten fourth prizes of £10, are offered; the entry fee is 1s; the closing date is June 30th, 1954. Entry-registration forms (obtainable from the Society at John Adam Street, Adelphi, London, W.C.2) must be returned by February 15th.





The Hawker Sea Hawk F.1 and the McDonnell Banshee, below, differ in many respects. The Sea Hawk is powered by a single centrifugal Rolls-Royce Nene; the Banshee has a pair of axial Westinghouse J34s. Both, however, carry four 20mm cannon and have tankage for long range. The F2H-4 Banshee is fitted with Hughes intercepter fire-control.

CANADIAN NAVY'S CHOICE

SOME readers will recall the policy considerations which surrounded the original decision to build North American Sabres in Canada and re-equip Royal Canadian Air Force squadrons with them. There were regrets in Canada, we believe, that suitable British machines were not available for adoption (to follow the Vampires); but, even if they had been, the Sabre decision would probably have been taken—for what may be described broadly as geographical reasons. There would be obvious risks if Canadian defence were to be dependent upon factories in a country so liable to attack in war, and upon such long and vulnerable supply-lines for spares. As things have turned out, the Canadians have been well pleased with their Sabres, and the ability of their industry to provide some for the R.A.F. as well has proved a godsend.

To meet the requirement of the Canadian Department of Defence Production for "local procurement of strategic materials," several British companies have during the last year or two speeded-up their plans to open factories in Canada for the manufacture of major aircraft components.

Once again any feelings of sentiment there may be have apparently had to be forgotten in the re-equipment planning for the Royal Canadian Navy. Aircraft of the four operational squadrons—two of Hawker Sea Furies and two of Grumman Avengers—must be replaced and, according to reports, the successors will be McDonnell Banshees and Grumman S2Fs. Many people over here, naturally enough, had hoped that the choice would fall on the Hawker Sea Hawk and the Fairey Gannet, for these match the performance of the two American designs and are clearly the cheapest and most efficient aircraft in their class.

A good deal more information about the proposed contracts is forthcoming from American sources than from those in Ottawa, but last week it was learned officially that the Canadian Navy were completing arrangements for the purchase of Banshees from the United States Navy. At the same time an official estimate of the number was given as thirty for a price of ten million dollars.

A previous American statement had said that the contract was for sixty Banshees costing twenty million dollars. The American report also added that 25 would go to H.M.C.S. *Bonaventure* for the carrier-borne fighter squadrons and 25 more to a land airfield, while ten would be retained for training.

The F2H-3 Banshee is by no means a new aircraft, having been in service with the American Navy for some two years. It is not regarded as Mig-worthy. Powered by two small Westinghouse J34 axial turbojets, it has a performance comparable with that of the Sea Hawk, which is itself in the 600 m.p.h. class. Many months ago some remarkable high-altitude photographs were released which had been taken from a Banshee at about 47,000ft. Thus the ceiling of this naval fighter can be considered good. The price of the Banshee is in the region of £120,000 whereas that of the Sea Hawk F.1, which might have been adopted in its place, is likely to be in the region of £50,000.

Regarding the replacement for the Grumman Avenger, it is learned that an order for 250 Grumman S2Fs may materialize. They would be built under licence in Canada, probably by Canadian Car and Foundry, a company which has close American connections. These bulky twin-piston engine aircraft are only just beginning to come off the production line in America and they are able to tackle the same sort of jobs as can the Fairey Gannet. Both machines are capable of about 300 m.p.h., but once again there is a considerable price discrepancy, that of the S2F being about £140,000 compared with £80,000 for the Gannet. Price figures, incidentally, vary from contract to contract but our Sea Hawk estimate is based on the offshore price which has been quoted and the Gannet price is that paid by Australia.

Another contrasting pair are the Fairey Gannet AS.1 and Grumman S2F, though both enjoy twin-engined flexibility: the Gannet has a Double Mamba (one feathered, above) and the S2F two Cyclone 9s. The three-seat Gannet is more compact than the four-seat Grumman; neither carries fixed guns, but both have provision for a heavy assortment of anti-submarine weapons.

HIGH-ALTITUDE COCKPIT COMFORT

Design-problems Discussed in an S.A.E. Lecture

PROBLEMS arising in the pressurizing and air-conditioning of fighter cockpits formed the subject of one of the lectures delivered at the recent National Aeronautic Meeting, held at Los Angeles, of the Society of Automotive Engineers. The paper was by Mr. George A. Lemke, a design specialist of Consolidate Vultee Aircraft Corporation.

The lecturer's aim was to clarify and co-ordinate certain factors in this sphere of design-activity. Basically, he pointed out, the air-conditioning system had to provide cooling for an electronic installation which produced 60 times more heat than the pilot's own body, as well as anti-icing, windscreen demisting and rain clearance. These functions were carried out by a system utilizing air bled from the engine compressor, ram-air-driven turbines and heat-exchangers (Fig 1).

Since the electronic equipment was designed for air cooling and required four times the cooling needed for the cockpit, it was essential to use air-cycle-type refrigeration. The requirement for constant cooling-air flow at varying engine speeds, altitudes and outside air temperatures necessitated a turbine with a wide operating range and therefore with variable-area nozzles. Furthermore, the electronics required four separate types of alternators and generators which, for convenience, should be remotely driven with a single speed control for all four. It was found that both for weight and power-consumption a turbine driven by compressor air bleed was preferable to a direct engine accessory drive. The generator driving turbine was given the name A.T.M. (air turbine motor). The A.T.M. was located after the heat-exchanger, since it had been found that the flow of air bled from the compressor was still sufficient, after passing through the heat-exchanger, for the turbine's power requirements. With such an auxiliary power source all the aircraft's electronics and other services could be ground-run with a normal ground compressor for test and repair purposes.

Both pressurization and cooling were provided by the air bled from the engine compressor and led through the ram-air heat-exchanger and then the A.T.M. expansion turbine. These two together reduced the air temperature sufficiently for cockpit-cooling purposes, while still providing a sufficient mass flow for pressurization. The majority of cooling air passing through the A.T.M. was used in the cockpit, but a proportion was led through electronic compartments for cooling [as illustrated below, Fig. 1]. Primary flow, however, passed into the cockpit, cooled and pressurized it, and was then led to electronic compartments, to the A.T.M. compartment and finally to the engine-accessory compartments. When the air returned to the accessory compartment it had a temperature of 160 deg F, which was still cool in comparison with the 800 deg F of the engine itself. A cockpit pressure regulator (shown in Fig. 1) maintained sufficient back pressure to pressurize the cockpit while yet allowing an adequate cooling flow to reach the various compartments to be cooled.

Mr. Lemke then gave an explanation of the characteristics of pneumatic power drives, following which he turned his attention to the actual operating conditions through which adequate cooling, pressurization and services would have to be maintained. He dealt first with the power requirement. A critical condition, he said, was during idling at extreme altitude. This condition—met mainly during let-down, throttled back, from altitude—was only transient in that power delivered improved as denser air regions were reached. The following compromises could be allowed: A.T.M. power-loss could be treated as a calculated risk; automatic monitoring of non-essential electrical loads could be provided; non-essential electrical loads could be cut out by switches on the throttle control; and cabin pressure could be reduced with throttle closed. Conditions arising during approach to land could be dealt with similarly.

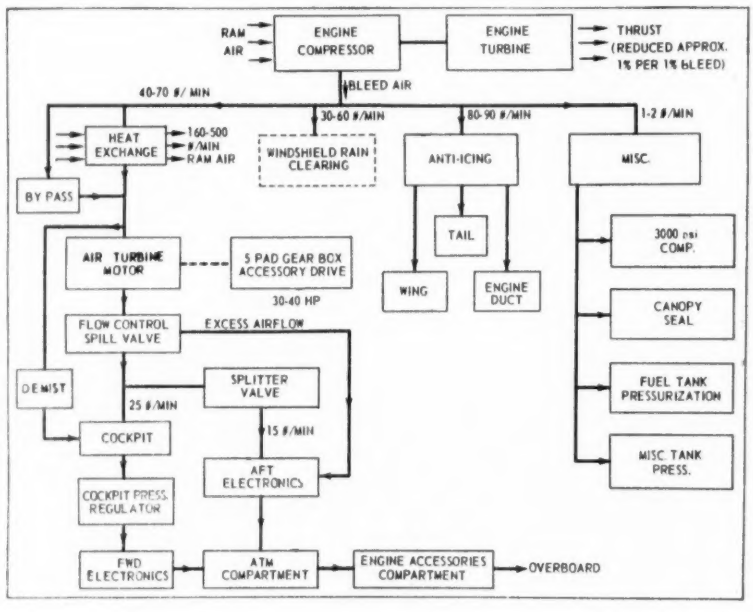
For cooling, Mr. Lemke defined four conditions: the ratio of turbine inlet pressure to discharge pressure, the effectiveness of the heat-exchanger, the efficiency of the turbine and the ram cooling-air temperature. The critical condition would be during high-speed flight at sea level on a hot day. Ram air would be hot and mass flow high enough to close the turbine nozzles to the minimum position, causing considerable reduction in cooling efficiency. The following compromises should be considered: to allow cockpit temperature to rise, taking advantage of the temperature lag in both equipment and pilot; to inject water into the heat-exchanger ram airflow; to inject water into the A.T.M. discharge, reducing temperature but increasing humidity; or to use a second heat-exchanger.

So far as cooling of electronic equipment was concerned, Mr. Lemke thought that the best progress could be made with equipment which would operate at higher temperatures rather than with increased cooling. While such equipment was being developed he suggested the following compromises: that materials sensitive to high temperatures should be eliminated; that components which create a high temperature should be insulated by using shielding and reflective or absorbent surface finishes; that evaporative cooling systems should be used as an alternative (such devices were already under development) and, finally, that reduced cooling during transient conditions of short duration, taking advantage of temperature-lag in the equipment, should be allowed.

Concerning the heat-exchanger itself, Mr. Lemke defined the optimum ratio of ram flow to compressor-bleed flow as 3 to 1. This ratio, however, could not be maintained, since compressor-bleed mass flow increased with altitude whereas ram airflow decreased. The varying ratio of flows with altitude led to a reduction in temperature-drop and a decrease in power per lb of air in the A.T.M. The following compromises could be made in selecting the heat-exchanger: to increase the size of the heat exchanger (within space and weight limitations), or to provide variable efflux area for the ram cooling air duct.

Mr. Lemke next dealt with cockpit "inside fog" caused by water entrainment. This occurred when the A.T.M. discharge temperature dropped below the wet-bulb temperature corresponding to the pressure in the cockpit. The water in the air reached its dewpoint and condensed, forming water vapour. Reduction of cockpit visibility through inside fog was, for obvious reasons,

Fig. 1. The cockpit conditioning and ancillary power system described by the lecturer. This system is typical of modern American practice.



The

ROLLS-ROYCE

AVON

is in World Demand.

COMMONWEALTH AIRCRAFT CORPORATION, AUSTRALIA

FABRIQUE NATIONALE, BELGIUM

HISPANO-SUIZA, FRANCE

and

SVENSKA FLYGMOTOR A/B, SWEDEN

in addition to the

ROLLS-ROYCE

and other factories in Great Britain

are all making it.

•

Rolls-Royce Limited, Derby, England.

Something New in the Air

Saab-91 Safir
now a four-seater

The well-known *Saab-91 Safir* 3-seat all-metal training and touring aircraft is now available in a new and comfortable *4-seat model* — the Saab-91C. Especially designed for executive and pleasure travel as well as for taxi and feeder use, the new Safir is also equally suitable as a light "utility" or ambulance transport. By removing the rear seats, a quarter-ton cargo can be easily carried. Like its predecessors, the 91A and the improved 91B Safir versions now in use with several air forces and government flying training schools, the 91C Safir can also be used as a primary trainer up to the more advanced stage of jet training. All this makes the new Safir one of the world's most versatile light aircraft.

A stretcher case can be easily loaded into the Safir. The new model 91C can also accommodate a medical attendant

SAAB-91C
SAFIR
Four-seat light aircraft

SAAB

Power	one 190 h.p. Lycoming O-435-A "flat six" aircooled engine driving a v.p. propeller.
Span	10.6 m (34 ft. 9 in.)
Length	7.95 m (26 ft.)
Wing area	13.6 m2 (146 sq ft.)
Weight Empty	745 kg (1,650 lb.)
Gross Weight	1,215 kg (2,686 lb.)
Max speed	270 km/h (168 mph)
Cruising Speed (Sea Level)	240 km/h (150 mph)
Service ceiling	5,100 m (16,800 ft.)
Normal range	900 km (560 miles)

(All figures relate to 1,215 kg (2,686 lb.) weight)

SVENSKA AEROPLAN AKTIEBOLAGET (SAAB AIRCRAFT COMPANY) · LINKÖPING · SWEDEN

HIGH-ALTITUDE COCKPIT COMFORT . . .

extremely dangerous. (In the early days of such systems the fog was thought to be smoke, and many pilots baled out, assuming their aircraft to be on fire.) Inside fog occurred most frequently when the aircraft passed through clouds at relatively low altitudes. It could be avoided in modern fighters if the pilot selected high cockpit-temperature on his automatic temperature-control.

A further problem with these cockpit conditioning systems arose if exhaust smoke from missiles entered the engine intake and passed thence into the cockpit. Since the pilot breathed mainly oxygen the effect was to be considered mainly in relation to cockpit visibility and body absorption. Air contamination through oil leaks in the engine compressor was considered unlikely, since, if such a leak occurred on a modern engine, it would almost certainly indicate engine failure, and contaminated air would no longer reach the cockpit.

Mr. Lemke finally dealt with the services other than cockpit conditioning and ancillary drive turbines, which were also operated through air bled from the engine compressor. These systems included anti-icing, windscreen demisting, windscreen rain clearance, fuel-tank pressurization and cockpit canopy seals. Air bled for anti-icing would amount to 80-90 lb/min. It would not be required above 20,000ft, at high speed, or for long periods, because the aircraft could rapidly climb beyond icing regions.

Since the fighter's windshield and canopy were thick and strong to resist pressurization and high-speed-airflow loads, they had an appreciable temperature-lag. While cruising at high altitude their temperature dropped; if brought rapidly to low altitude they would then invariably mist up, due to condensation. The most common method of obviating this was to blow hot air over them. This required about 4 lb/min of compressor-bled air. Other methods (principally electrical) were, however, available and preferable. Compromises could be made in the extent of demisting provided both in the area demisted and intensity of demisting.

Since rain formed an untransparent layer of water over the windscreen some method of clearing it was desirable. Repellents were efficient but short-lived. Windscreen wipers were too weak to stand up to high-speed airflow. It had been found, however, that jets of air directed at almost sonic speed across the windscreen would divert rain drops from it. Direct bleed air was too hot for this purpose, however, and flow from the A.T.M. limited and too slow. Pressure-regulators would also be required to cope with varying engine-bleed conditions during low power approach and full-power take-off.

Mr. Lemke now suggested a modified air-conditioning and ancillary-drive system (illustrated in Fig. 2) aimed at reducing to the minimum the aircraft-performance penalty caused by engine compressor bleeding, and at lessening the weight of the refrigeration and power systems. He suggested the following modifications: that the electronic equipment be cooled by ram air, which would itself be cooled by means of water evaporation when ram air temperature exceeded 100 deg F; use of electronic equipment, allowing higher component temperature; and intake pressure-drop low enough to permit cooling at high altitude. The pilot should be cooled by a ventilated pressure-suit and the cockpit allowed to seek its own temperature level. Finally, maximum cockpit differential pressure should be reduced to 1.5 lb sq/in (a maximum cabin altitude of 40,000ft) this pressure being maintained by air discharged from the pilot's suit. The pilot would use a pressure-breathing oxygen system.

The above conditions could be achieved with ram cooling flow over the electronic equipment of approximately 40 lb/min. During high-speed flight water injection would cool ram air to 100 deg F. This would be automatically controlled and the ram cooling airflow adjusted by a flow control valve to allow for altitude. The small amount of engine bleed air required for the pilot's ventilated pressure suit would be cooled by passing it through a heat-exchanger located in the cooling ram air duct ahead of the electronic equipment.

Mr. Lemke ended by stressing that in his opinion the principal lines of progress in the field of air conditioning and cooling, lay in the development of self-cooling electronic equipment and in the introduction of ventilated pressure suits for pilots.

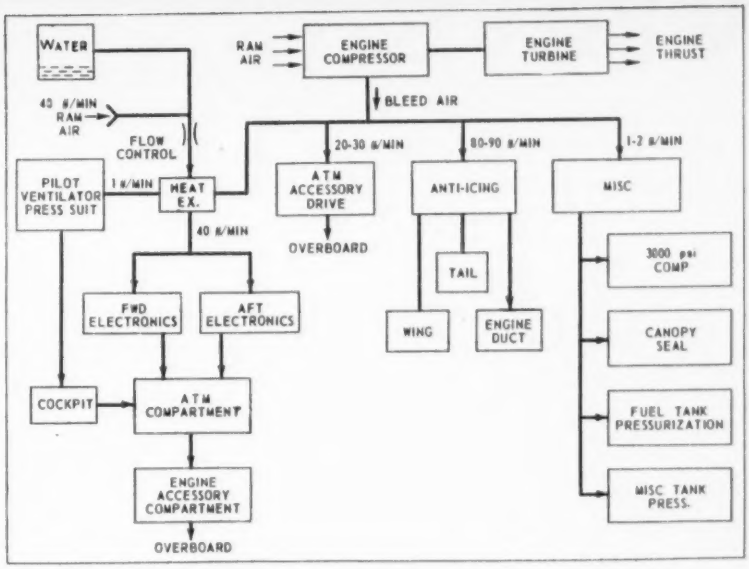


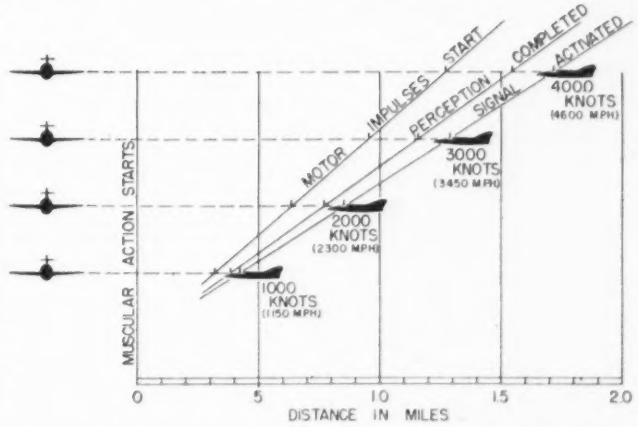
Fig. 2. The lecturer's suggestion for a simplified system reducing the load in engine compressor bleeding.

AIRCREW at ALTITUDE

THE physiological effects of high altitude were discussed in another lecture at the S.A.E. meeting. Bearing the title *Taking Man to Higher Altitudes*, this paper was by Mr. A. M. Mayo, head of the equipment and interiors engineering section of Douglas Aircraft.

He began by saying that, in the endeavour to reach higher altitude, both the physical stresses and the physiological load on the human pilot had tended to increase. But the total efficiency of the man-machine combination depended on the individual efficiency of the two parts and excessive reduction of the man's efficiency by an accumulation of a number of relatively light stresses became a very serious factor.

Flying in reduced pressures above those altitudes where the mere addition of oxygen was sufficient for the pilot's needs brought certain effects beyond simple hypoxia*: for instance, "bends" and "chokes," and excessive swelling due to evaporation of liquids within the body. Simple compression of outside air to produce suitable cockpit atmosphere became inadequate above 70,000ft. In the ozonosphere, simple pressurization could produce



The time-lag between visual sighting of an obstacle and initiation of avoiding action is here graphically shown. This is but one of the problems of high speed flight.

* *Oxygen deficiency at high altitude, a condition normally relieved by adding a proportion of pure oxygen to the air inhaled; the term anoxia, often regarded as synonymous, actually implies a complete lack of oxygen*—ED.

AIRCREW AT ALTITUDE . . .

poisonous concentrations of ozone. For short flights above 70,000ft, however, a simple storage system utilizing liquid oxygen was probably capable of providing both cooling and pressurization. The small amounts of carbon dioxide, water vapour, and excreted body gases could be tolerated for these short periods. But for extended flights above 70,000ft the pilot would have to "bring his atmosphere with him." In case of sudden decompression, he would also require an efficient pressure-suit.

On the subject of aircraft skin-friction, Mr. Mayo said that, with greatly decreased air-density, the heating from friction would give way to that caused by radiation from the sun. The primary temperature-control in flight above the atmosphere became a function of stored energy and radiant-heat transfer. For re-entry to the atmosphere, heat dissipation by radiation would have to be accomplished within the temperature limitations of the structure to prevent the aircraft "falling into the category of a vaporizing meteor." Air-cycle refrigeration systems would remain practicable up to 70,000ft. Above this, liquid-oxygen storage systems for short flights would give way to a radiant-heat transfer system entailing greater or lesser proportions of dull (high-emissivity) surface presented to the direct rays of the sun.

In dealing with acceleration loads, Mr. Mayo considered that considerable progress in clothing and body-position control either had or could be made, thanks to the extent of gravity research already carried out. But more information was required on the effects of accelerations of rapidly varying direction and magnitude; the case had to be considered where high loads alternated in direction at a rate greater than the response of human reflexes.

Noise, the speaker continued, decreased or ceased altogether at supersonic speeds and in rarefied atmosphere. Precise data were, however, required in order to prevent fatigue or injury to personnel and to allow proper utilization of communications equipment.

As for radiation effects, no one could categorically state that serious biological damage would not result from extended flight in free space. Such injury might result from solar ultra-violet radiation, solar X-rays, cosmic particles, or other heavy ionizing radiations. Shielding would be necessary against some or all of these factors. Similarly, protection would be required against meteorites, although the vast majority of them were too small to cause serious damage. For example, an aircraft with a cross-sectional area of 1,000 sq ft might fly for a hundred years before having its $\frac{1}{8}$in simple duralumin skin penetrated by a meteorite. One economical and effective solution would be provided by a double skin, on the outer layer of which meteorites would be caused to explode harmlessly. It did at least appear that serious meteorite-damage fell in the probability category of a lightning-strike in everyday life.

Whereas research had concentrated on the effects of one isolated physical stress on the pilot, it was important to know the effect of combined stresses. Some stresses had a direct additive effect on the same body system, while others individually affected more than one body system. The speaker considered a combination of individually acceptable stresses to be at the root of many accidents hitherto attributed to such factors as pilot error or target fixation.

A major factor in high-speed flight was the effect of the normal time-lag for the human operator in taking action after receipt of sensory stimuli. Such factors could be clearly illustrated by a diagram (shown by the lecturer and reproduced on page 727). Such a time-lag could, of course, be dangerously increased by ineffective cockpit lighting in the sharp shadow conditions prevailing at extreme altitudes.

Cockpit design would, subject to economic, moral and military factors, have to include an adequate emergency escape system. This the speaker considered to be a relatively straightforward engineering problem.

Finally, Mr. Mayo laid out four conditions which should be considered in relation to every item of equipment installed in the cockpit: (1) Was the information or function of a device really necessary or important? (2) Could the crew-member effectively do anything about the situation of which the device apprised him? (3) Could all or part of the information or function be obtained from, or combined with, another device already included? (4) Was the information or function the simplest that would meet the minimum requirements? After establishing the basic size and arrangement of a crew compartment, primary consideration should be given to the design of items immediately adjacent to crew-members. In view of the facts considered, the speaker felt these latter points to be vital factors in the attainment of the proper efficiency of the man-machine combination.

TURBOPROPS NOT PREFERRED

IT was at a Society of Automotive Engineers meeting about five years ago, if we remember correctly, that Mr. Kelly Johnson of the Lockheed Corporation brought his biggest guns to bear in opposition to the case for the turboprop. Some observers subsequently estimated that so successful had he been that U.S. civil development of the turboprop power-plant was retarded by at least four years.

The subject of turboprop design and requirements came up again at the recent S.A.E. Los Angeles meeting referred to in the preceding pages. A paper was presented by two members of the development engineering section of American Airlines, whose president, Mr. C. R. Smith, has been showing some favour towards turboprops. A formidable opposition included the comments of Mr. Kelly Johnson, Mr. George Snyder of Boeing's preliminary design staff, and Mr. Carlos Wood who holds a similar position with Douglas; the defence, we learn, was negligible.

Whether or not Bristol, Rolls-Royce, Napier and others will applaud these events on the grounds that they give these companies an even freer field—and we think it is a large field—in world civil turboprop markets, or whether they will deplore the effect on North American opinion, we do not know.

As might be expected, the main basis of the attack was on the score of complication—reduction gears, airscrews and their controls—and also on economics. Unexpectedly, the by-pass and ducted-fan conceptions were to some extent lumped together with turboprops and damned along with them.

Speaking at a conference in New York last week, the president of the Curtiss-Wright Corporation, Mr. Roy Hurley, said: "Our turbo-compound is the right engine at the right place at the right time. The turbo-compound will gain the bulk of the market for ten to fifteen years. Nothing will take its leadership away. The Wright turbo-compound provides 1 h.p. per pound of weight and 1 h.p. per cubic inch of displacement. We are building all kinds of engines but the turbo-compound is preferred to the jet for commercial use because it is the most reliable and the most economical power-plant. The turboprop is the second best from the standpoint of economy." He went on to say: "We have nothing against the jet. The airlines are working with us. The advance of the jet engine to better efficiency and the use of larger planes, perhaps twice as large as the DC-7, will eventually bring the turboprop or turbojet engines into greater usefulness on the airlines."

TECHNICAL TRAINING IN THE R.A.F.

A DESCRIPTION of the R.A.F. aircraft apprenticeship scheme was given before a meeting of the Society of Licensed Aircraft Engineers in London on Saturday last, November 28th. The lecturer was G/C. R. J. Carvell, who is Senior Training Officer and Assistant Commandant at the Apprentice Technical Training School, Halton.

After outlining the history of the scheme, G/C. Carvell described the trades available, qualifications and the period of service for apprentices. He mentioned the Radio Engineering School at Locking, but in the main body of the lecture concentrated on Halton, where all the remaining apprentice trades were taught. More than 2,000 apprentices, belonging to nine entries, formed the normal establishment, and among the other statistics presented by the speaker was the interesting minor fact that marching time between barracks, workshops and schools amounted to 4½ hours per week per apprentice.

The training programme was then described in detail by G/C. Carvell, who said in conclusion that, since the inception of the school, over 21,000 apprentices had passed through it. Over 4,000 of these had been commissioned, and some had attained the rank of air vice-marshal.

SPICER MEMORIAL CONTEST FOR 1954

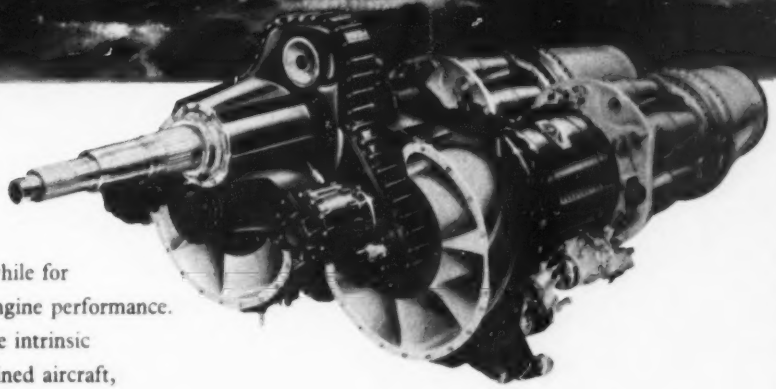
DETAILS of the 1954 Dorothy Spicer Memorial Prize Essay Contest, the sixth to be held, have been announced by the Society of Licensed Aircraft Engineers. All licensed aircraft engineers within the British Commonwealth and all members of the Society are eligible to submit entries, which should not exceed 5,000 words.

Essays may have as their subject any aspect of the design, construction, operation, maintenance and/or repair of civil aircraft (including rotorcraft), high-speed military aircraft, or guided missiles; or general aspects of aviation such as air legislation, personnel licensing, aviation history, air traffic control and aerodrome facilities. It is stated that entries will be judged on the basis of the ideas expressed in them rather than for their length or literary standards.

The final date of entry is March 31st, 1954. Entry forms, rules and full details of the contest can be obtained from the general secretary of the Society at Finsbury Circus House, Blomfield Street, London, E.C.2 (London Wall 6356).

ATTACK IS THE SUREST DEFENCE

Death to the lurking submarine — carrier borne Fairey Gannets patrolling far from the convoy seek out and destroy the enemy before he can close to striking range.

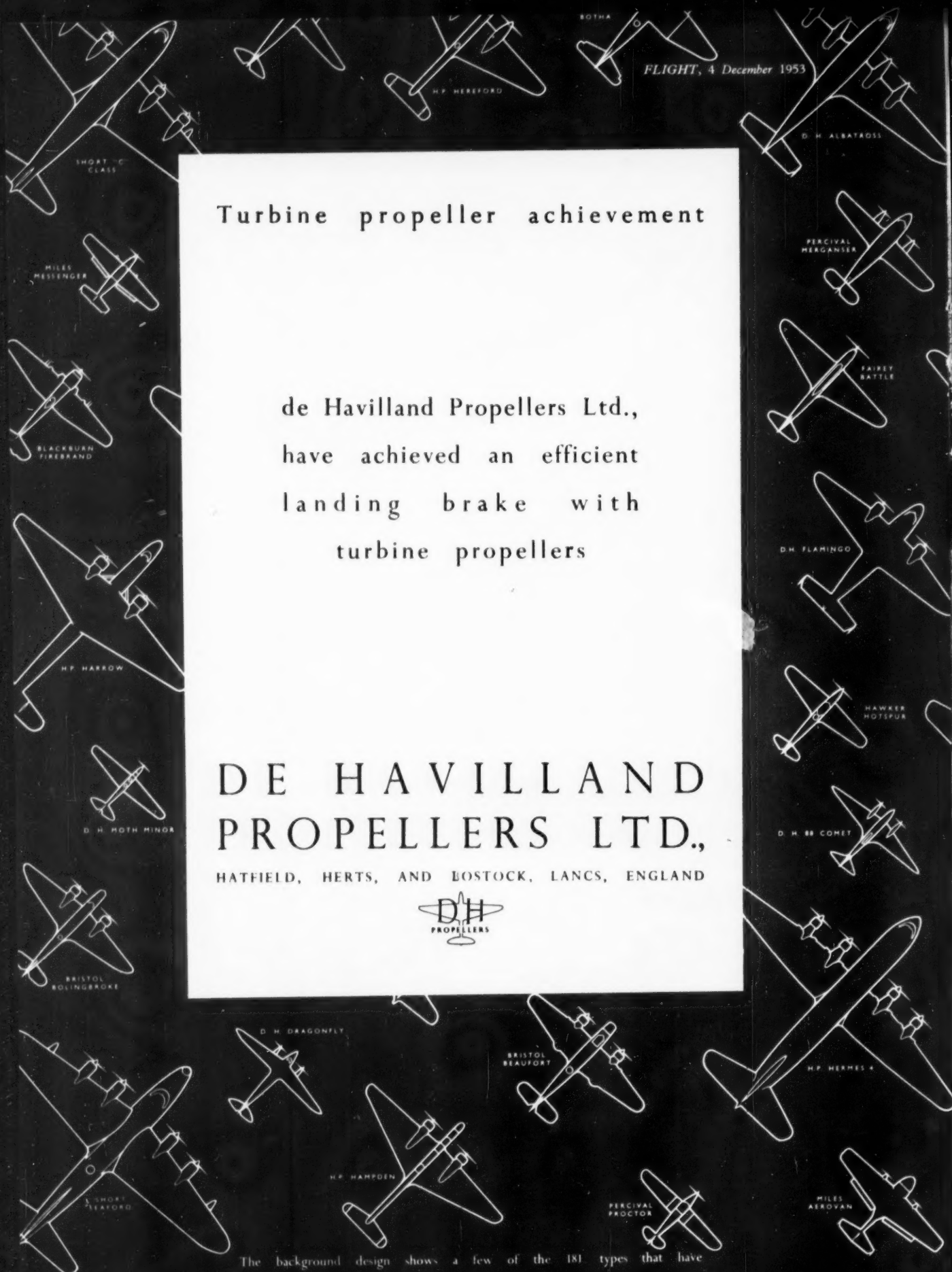


The Gannet owes its long range to the Armstrong Siddeley Double Mamba turboprop; cruising with one engine shut down the fuel consumption is comparatively low, while for attack with both engines the Gannet has full twin engine performance. Aircraft equipped with the Double Mamba have the intrinsic stowing and fuel economy advantages of single engined aircraft, with the safety factor and power potential two engines provide.

THE DOUBLE MAMBA TURBOPROP

Two engines in one for the anti-submarine Fairey Gannet—Super-priority for the Royal Navy and the Royal Australian Navy

ARMSTRONG SIDDELEY MOTORS LIMITED · COVENTRY *Members of the Hawker Siddeley Group*



Turbine propeller achievement

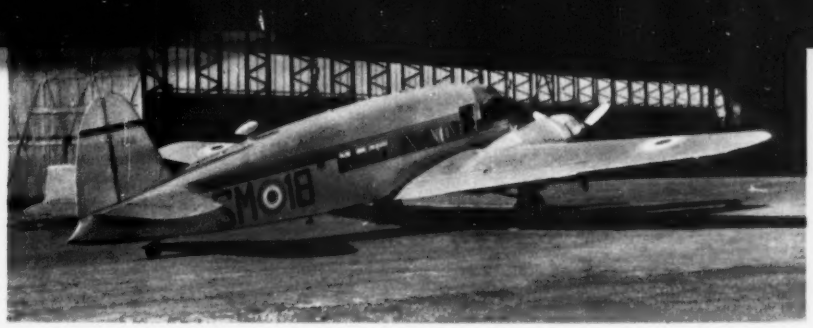
de Havilland Propellers Ltd., have achieved an efficient landing brake with turbine propellers

DE HAVILLAND PROPELLERS LTD.,

HATFIELD, HERTS, AND BOSTOCK, LANCS, ENGLAND

D.H. PROPELLERS

The background design shows a few of the 181 types that have been fitted with de Havilland propellers in the past 18 years.



VISITING ITALIAN: Photographed at Bovingdon recently was this SIAI-Marchetti SM.102 of the Italian Air Force. These Anson-like machines are frequent visitors to this country on various communications duties. Originally tested with Ranger in-line engines, the SM.102 is now powered by a pair of 550 h.p. Wasps, which give a cruising speed of some 180 m.p.h. The cabin is usually fitted for eight passengers.

AIRCRAFT INTELLIGENCE

Great Britain

*Blackburn B.*105. Renewed activity in connection with the Blackburn feeder-liner project, the B.105, has been noted. The original design, which was believed to be joint favourite with another (by Short's), was prepared to meet B.E.A.'s. "Rapide-replacement" specification in 1948. The B.105 has been improved year by year, and is now somewhat different from the model depicted on p. 364 of our issue of March 20th last. Four direct-injection Bombardiers, which have themselves been developed, provide power. American reports praise the calculated landing and take-off qualities.

Folland Gnat. While Folland press on with the construction of two Gnat prototypes—one of which may possibly startle Farnborough-goers next year—the company await a suitable engine. The prototypes, it will be recalled, are to fly initially with a Viper of some 1,600 lb thrust. An American report now states: "Bristol Aeroplane Co., Ltd., is reviving its Saturn turbojet . . . originally scheduled for 3,800 lb thrust. . . . After British Ministry of Supply refused to support the Saturn project, Petter [Folland's managing director] found private backing to revive the project as a 4,000 lb. thrust engine." We know that neither Bristol nor Folland can comment on this statement.

After the Viscount? Many reports—all premature, we believe—are circulating in regard to a successor to the Viscount. Vickers are said to have prepared an 80-seat design to a B.E.A. specification, with an all-up weight of some 90,000 lb. One report mentions a high-wing layout—which, it is known, Mr. Peter Masefield favours as a result of appreciative passenger-reaction to his Elizabethans. At the same time a new Rolls-Royce turboprop of 3,000 h.p. (rising to 4,000 in four years) is in the news.

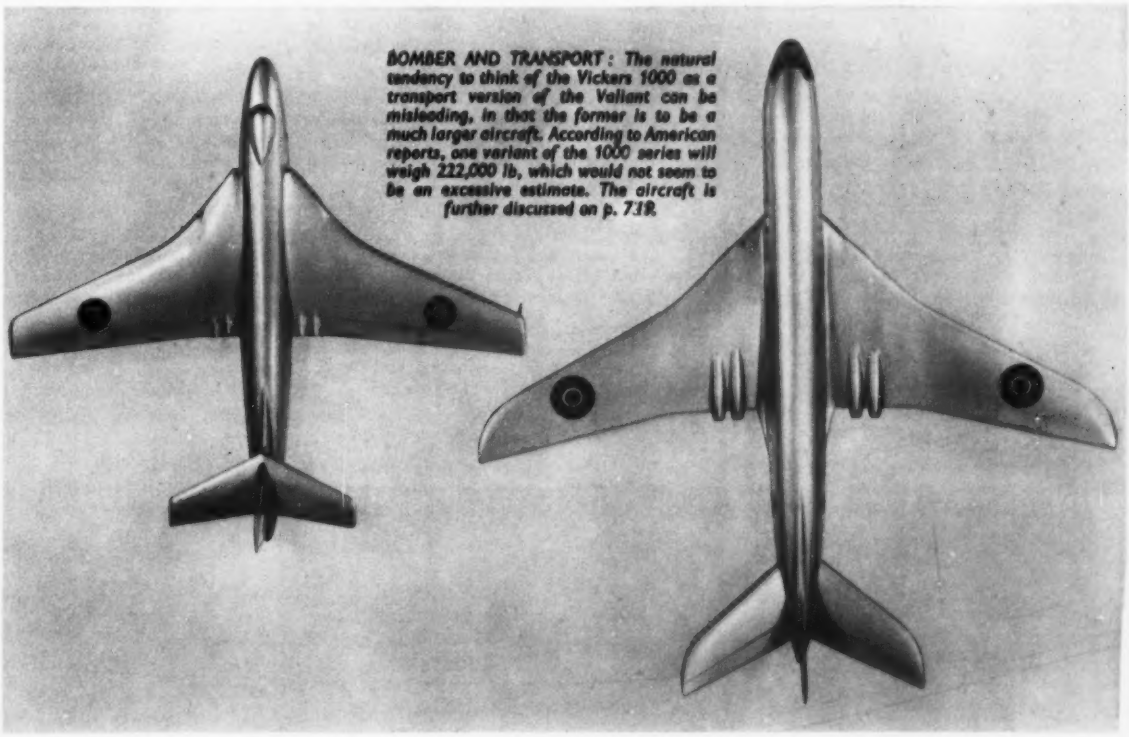
United States

*Douglas XB-*43. This was the first American jet bomber, and was developed directly from the pusher XB-42 "Mixmaster" of 1944. Originally powered by two Allison J35s, the XB-43 was often used to test other engines, mounted in place of one of the J35s; by this means were obtained such data as the minimum safe lubricating-oil flow for the J47, and tests made for the development of pressurized oil tanks and high-altitude starting equipment. Now, after nearly ten years of such work, the machine has been retired; it is to be given a place of honour in the National Air Museum. What, we wonder, will happen to the first Canberra, VN 799?

*Douglas XC-*132. Long-heralded as the first production aircraft to have a payload of 100,000 lb, this U.S.A.F. heavy transport design is now known to be radically different from the C-124 Globemaster. The prototype should fly in about eighteen months. It will, in fact, be a twin-boom aircraft with a layout roughly similar to that of the Fairchild Packet. Four or six two-spool turboprops, of 15,000 s.h.p. each, will be used, to give a cruising speed over 300 m.p.h. The all-up weight will approximate to 400,000 lb and the wheel-track will be 100ft. One version will be a flight-refuelling tanker.

Fairchild Friendship. In addition to their own projected transports (see p. 738), Fairchild are trying to sell the Fokker F.27 Friendship transport, of which two are now being built; the company have a sales-licensing agreement with Fokker. Up to a total of 150 aircraft, the Friendships would be built in Amsterdam; greater output would require licence-production by Fairchild. The break-even for Fokker is given as a total of 65 aircraft at $450,000 each. Any bought in America would be serviced by Fairchild, and deliveries could be made by 1956. The Friendship has two Rolls-Royce Darts and is a high-wing "DC-3 replacement."

*North American YF-*100. It is confirmed in America that the first prototype Super Sabre really did achieve supersonic flight on its first test flight. This flight lasted 55 minutes and, since then, the machine has completed over 50 hours; remarkably, more than half this time has been supersonic. It is possible that the single YF-100 already has more supersonic time than all other fighters put together. And it is reported that no change of trim is necessary while going "through the barrier." Other F-100 news is that, as might be expected, North American are developing an all-weather version, with a nose rather like that of the F-86D, and that a "navalized" development is under consideration.



BOMBER AND TRANSPORT: The natural tendency to think of the Vickers 1000 as a transport version of the Valiant can be misleading, in that the former is to be a much larger aircraft. According to American reports, one variant of the 1000 series will weigh 222,000 lb, which would not seem to be an excessive estimate. The aircraft is further discussed on p. 712.

BEYOND MACH 1

The Remarkable Vehicles of Airborne Supersonic Research

ALTHOUGH World War II was fought entirely with subsonic aircraft of what was then a conventional layout, that conflict left an enormous legacy of research in the fields of high-speed aerodynamics and power units. So great was this legacy that it opened the way to aircraft with a standard of performance which could only be dreamed of at the time.

In 1945 it was, therefore, perfectly natural that any country with sufficient resources should pick up the threads of research, sort them out and build experimental aircraft capable of evaluating all the projected novel wing plans and control systems and, into the bargain, piercing the mysterious "sonic barrier." It must be remembered that, although a great deal had been known about supersonic flight for many years, from the study of projectiles, there still existed at that time an almost complete transonic-region gap in all the plotted curves of Mach number against drag coefficient. This gap could not be filled by tunnel experiments owing to unavoidable choking as sonic speed was reached.

It had always been clear that, for proper transonic data, full-scale free flight experiments were essential. Eight years ago this country could spare little effort on such work. The Miles company, with their M.52, had made a characteristically bold attempt at building a supersonic research aircraft around a reheated Whittle W.2/700 turbojet. The design was started in the middle of the war, and the razor-edged wing of double-convex section had already been successfully flight-tested in the "Gillette" Falcon.

In 1946 the Ministry of Supply cancelled the contract for the M.52 as it was felt that the project was too hazardous. This decision, for which we believe Sir Ben Lockspeiser was principally responsible, has since been the subject of considerable controversy. In place of the M.52 a contract was placed with Vickers-Armstrongs for a number of small unmanned vehicles powered by liquid-fuel rockets, which were launched over the sea from Mosquitoes. It appears to be generally agreed that the data provided by these models was a poor substitute for that which would have been gained from tests with a manned aircraft.

Across the Atlantic, it must be admitted, national temperament and resources combined to present a far more effective challenge to the problems involved. Several distinct programmes were undertaken, correlated by the National Advisory Committee for Aeronautics, and using aircraft ordered under normal Air Force or Navy contracts. As in other aspects of American aeronautical progress, too, the keen rivalry between these two Services was a further spur. It should be stated at the outset that, in the design of these aircraft, very considerable use was made of German data.

Initially, the Bell company were asked to build a rocket-propelled supersonic aircraft for the Air Force, while Douglas began the development of high-speed machines for the Navy. At the same time, Convair were given a contract for a delta-wing machine, Northrop for an aircraft to test the tailless configuration at subsonic speeds, and Bell a further contract for a machine with a variable-sweep wing. The last three designs materialized as the XF-92, X-4 and X-5, and, in their own fields, have provided immensely valuable data.

The supersonic machines of Bell and Douglas are best treated quite separately. Bell were first, for the X-1 (originally XS-1) flew in the early part of 1947. It was a straight-wing machine with quite conventional controls and powered by a four-barrelled bi-fuel rocket motor of 6,000 lb thrust. With this aircraft, the technique of air-launching was pioneered, in order to permit full-load take-offs at wing loadings too great to permit operation from existing runways. On October 14th, 1947, the aircraft exceeded Mach 1, becoming the first manned vehicle to do so. The pilot was Major Charles E. ("Chuck") Yeager, U.S.A.F. The limits reached with the X-1 were 967 m.p.h. (1948), 70,140ft (1949), and Mach 1.5 (1947).

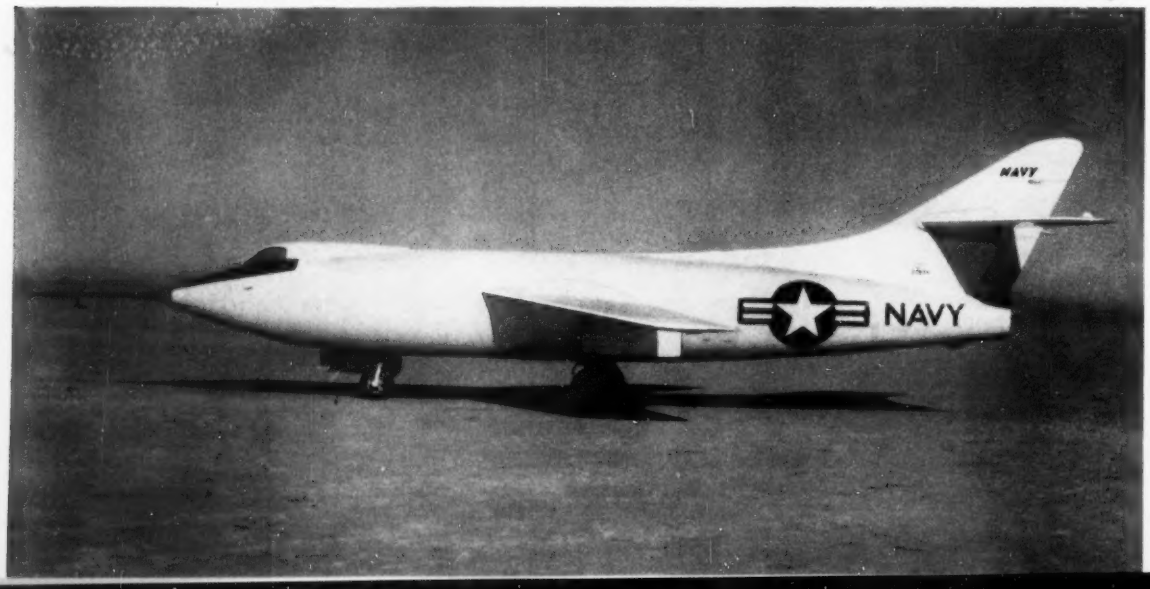
The chief disadvantage of the original Bell was its general inflexibility and short duration. A direct development was the X-1A, a larger aircraft differing principally in having greater tankage and a turbine-driven fuel pump (the X-1 used compressed-gas bottles). Pilot-view was also improved by fitting a raised canopy joined to the fin by a dorsal spine. The X-1A flew in the spring of this year, piloted by Jean L. ("Skip") Ziegler, Bell's chief of flight research. It has since proved a useful vehicle with a duration of 4½ minutes at full thrust, double that of the X-1. A still later development is the X-1B, the existence of which was revealed last September. It is superficially similar to the X-1A.

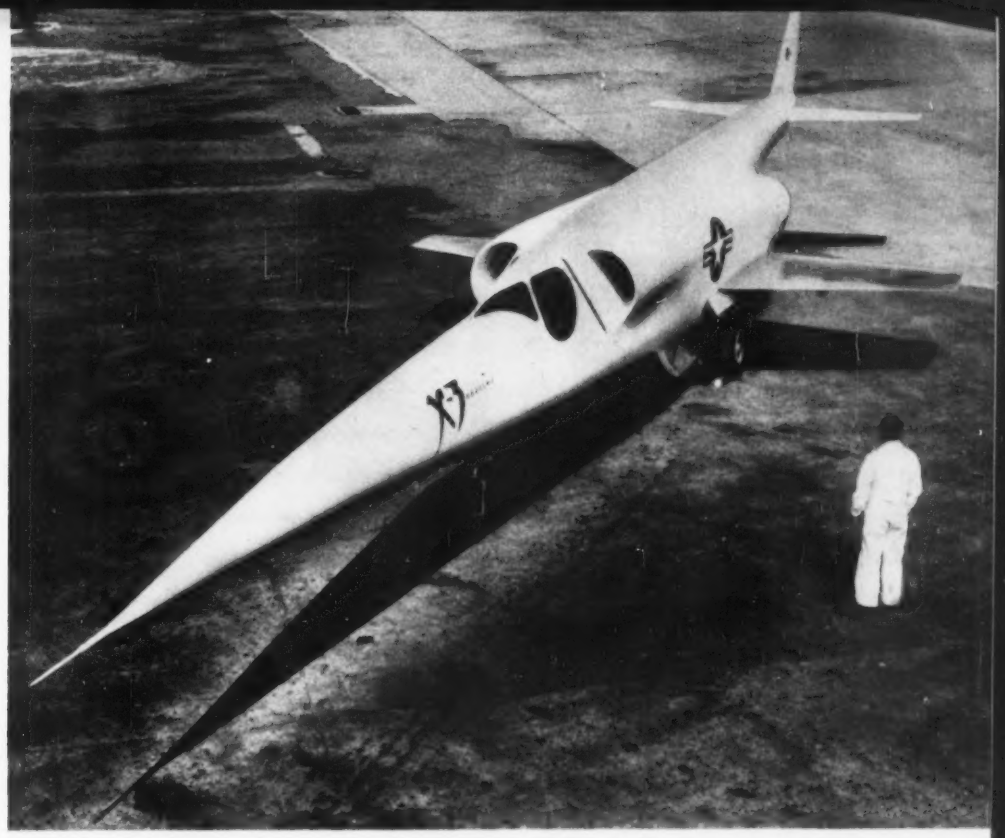
The fastest Bell of all is the X-2, powered by a Curtiss XLR-25 rocket motor, the thrust of which is controllable by a throttle. Of stainless-steel construction, the X-2 has highly swept wing and tail surfaces, and is designed for Mach numbers in excess of 2. The first machine was finished in the spring of this year, and was then taken aloft in a B-50 for trial launching. Unfortunately, there was inadvertent mixing of the alcohol and liquid-oxygen propellants as the tanks were being topped up immediately prior to release; in the resulting explosion, the X-2 was blown clear and completely destroyed, and two Bell employees, one of them Ziegler, were killed. A second X-2 has now been finished, but details of this aircraft or of its progress are not available.

The joint Douglas/Navy work began with the turbojet D.558-1 Skystreak, a straight-winged aircraft which set up a world speed record of 650 m.p.h. in 1947. The level Mach limitation was 0.85, although the airframe was strong enough to reach the speed of sound, which it almost achieved while diving. The D.558-2 Skyrocket is a quite different machine. It has a huge fuselage to house sufficient rocket fuel, and the wings and tail are swept, although the control system remains conventional. Each powered by a Westinghouse J34 turbojet in the belly, and a four-barrelled rocket in the tail, three Skyrockets were built, and they were initially flown from Edwards A.F.B., California. One aircraft was later air-launched from over 30,000ft and, in 1951, had its turbojet removed to make way for additional rocket-fuel tankage. Since that time, many notable Skyrocket flights have been achieved, all of them on aircraft powered solely by the tail rocket.

Back in 1951, the Douglas engineering test pilot, Bill Bridgeman, reached speeds and heights exceeding 1,200 m.p.h. and 75,000ft, after launching at heights around 33,000ft. During the current year, an equally noteworthy series of trials has established figures such as the following: altitude 83,235ft (Lt. Col. Marion Carl, U.S.M.C., August 21st); 1,143 m.p.h., Mach 1.7 at 68,000ft (same

The Douglas Skyrocket in its purely rocket-propelled form. Originally it was powered both by a rocket motor and a Westinghouse J34 turbojet, the flush intakes for which were situated one on each side of the nosewheel, while the efflux emerged beneath the tail, at a position under the U.S.N. insignia.





This photograph of the Douglas X-3 (two J34s) is the first to be published showing the narrow-track undercarriage, designed for take-off speeds of at least 200 m.p.h. Other pictures of this remarkable aircraft—"piloted missile" might be a more accurate description—appeared in our last week's issue.

pilot); and 1,272 m.p.h., Mach 1.96 (Scott Crossfield, N.A.C.A. test pilot, October 14th). As with the other experimental aircraft, the Skyrocket was first flown under Navy auspices, and was then turned over to the N.A.C.A. two years ago.

The latest Douglas is the Air Force/Navy/N.A.C.A. X-3, which was described and illustrated in *Flight* last week. Not surprisingly, it is known to Bill Bridgeman as "the beast." The X-3 is powered solely by turbojets, in order that it may approximate to a modern fighter. Originally designed for two Westinghouse J40s, totalling over 17,000 lb thrust, the X-3 is at present badly under-powered with two J34-WE-17s, totalling 9,000 lb thrust with afterburners. As a result, the aircraft probably cannot yet achieve its designed Mach number of 3 and certainly cannot fly high, although it has already provided a mass of data on aerodynamics and kinetic heating.

Apart from the lack of power, the X-3 suffers from an inordinate wing loading of some 200 lb/sq ft. The thin, stainless-steel wing is unswept and has a drooping leading edge, split flaps and conventional ailerons. The section is believed to be a double wedge with maximum thickness at about 70 per cent chord. As on the F-100 fighter, a single, powered horizontal tail surface is employed. The X-3 airframe contains 850 pinholes which measure local static pressure, 150 temperature-sensing points, and 185 strain-gauges.

Another factor, which could be of paramount importance, is that the X-3 has been made as representative as possible of what will eventually be standard practice for fast aircraft. Apart from the use of turbojets as the sole source of power the aircraft carries far more auxiliary power systems and equipment than do any of its predecessors. These earlier aircraft having been used to provide basic data, the X-3 is now going on to provide information which will be essential to the designers of Mach 3 *combat* aircraft.

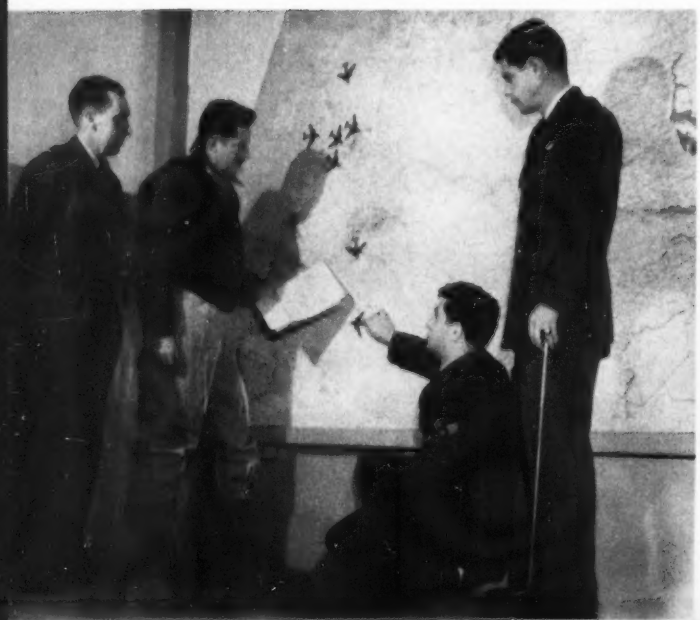
One set of reports will deal with the optimum hydraulic fluid to be used, capable of withstanding extremes of temperature; indications are that the chief trouble will be the high temperatures caused by aerodynamic heating, which, at Mach 3, can reach 500 deg F at extreme altitude, rising to well over 1,000 deg F at sea level. No hydraulic fluid at present used can approach these limits. Electronic equipment will be required to be capable of operation in similar temperatures, as will fuel systems and certain instruments. It appears to be impracticable to provide refrigeration capable of keeping the whole airframe at the temperature of the interior of the cockpit. Some notes on these problems appeared in our last issue, on p. 711, in which an engineer of the Ryan company suggested the use of the aircraft fuel system as the principal means of cooling electrical equipment.

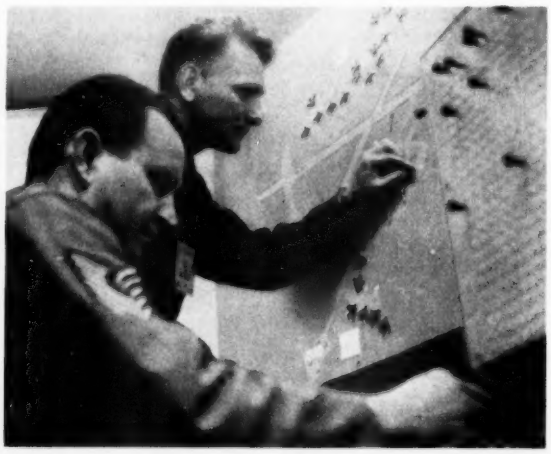
With such an aircraft as the X-3, the Americans have a world monopoly in that they can design fighters for speeds exceeding Mach 2 with a firm hand, knowing most of the problems and solutions in advance.

The Bell X-1A, developed from the X-1, the world's first supersonic aircraft; in contrast to its predecessor, it has a comparatively orthodox cockpit enclosure in place of a flush canopy, and there is greater tankage for rocket fuel. It meets a runway only on landing, for it is normally air-launched.

GLOBAL MOBILITY

BRIZE NORTON, Oxfordshire, is the scene of these pictures of the U.S.A.F. 305th Bombardment Wing, which was due to return yesterday, December 3rd, to its base at MacDill A.F.B., Tampa, Florida. The first Stratojet wing to arrive in England on rotational training was the 306th (three squadrons, each of fifteen B-47s, plus 20 KC-97 tankers), stationed at Fairford until relieved by the 305th last September. The long-range mobility of the B-47 units has been dramatically emphasized by their transatlantic flights; and the fact that one such move involves over 100 aircraft (including transport and support machines), 2,000 men and 500,000 lb of cargo, gives an idea of the logistics problems involved. The picture above shows one of the 305th Wing's B-47s, with some of the men and supplies which keep it flying. In the Brize Norton control room (below) a training mission is planned by (left to right) Col. J. Kunkel (operations chief), Col. E. Vandevanter, Jr. (305th Wing commander), Airman 1st class S. Gorgoglione (control-room chief), and Maj. L. D. Delamater, Jr. The remaining photograph shows maintenance moves being planned by Col. W. Hosler, Jr. (Wing maintenance director), and M/Sgt. W. L. Bryant. Each wing spends three months in England.





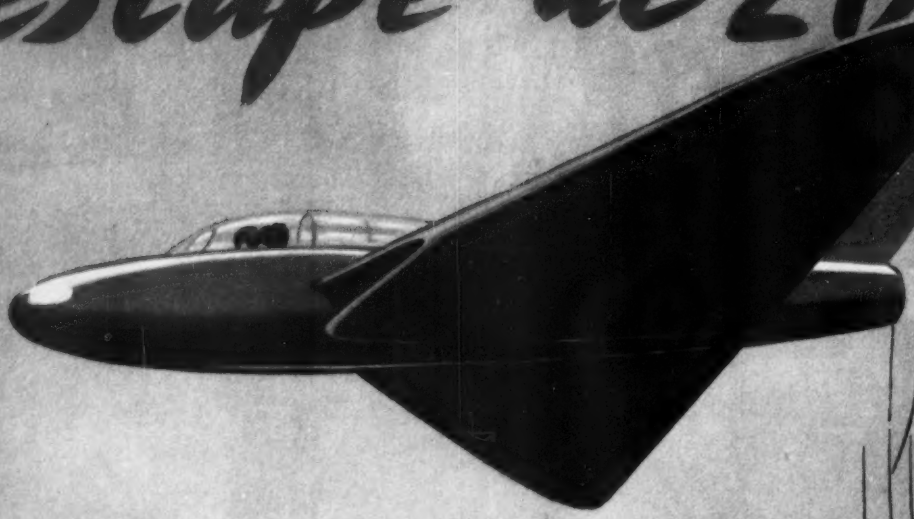
'ENGLISH ELECTRIC'
Canberra

POWERED BY
ROLLS-ROYCE AVON ENGINES

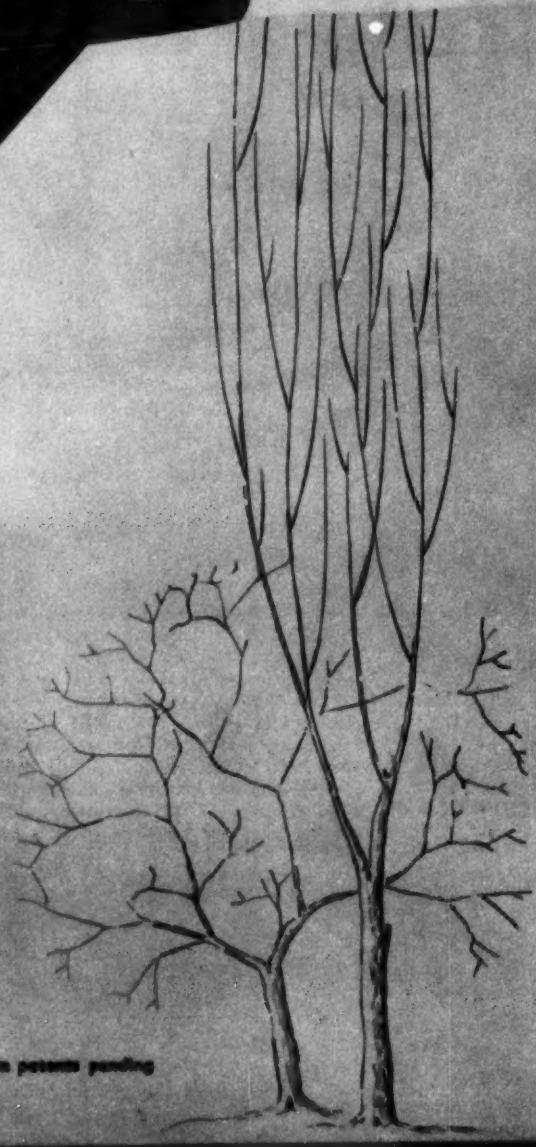
- THE ONLY JET BOMBER IN SQUADRON SERVICE WITH THE ROYAL AIR FORCE
- HOLDER OF 11 WORLD RECORDS
- CHOSEN BY 4 AIR FORCES
- IN PRODUCTION IN 3 COUNTRIES

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

escape at 200 ft.



Ejections in level flight at 200 feet, at speeds of 600 m.p.h., have been made with the Martin-Baker Patent Fully Automatic Ejection Seat, the result of seven years' intensive development; in the past two years we have developed the new Light-weight Fully Automatic Ejection Seat with an installed weight of only 50 lb.



* NOTE : Patented in the principal countries of the world, and certain patents pending

MARTIN-BAKER

AIRCRAFT COMPANY LIMITED · HIGHER DENHAM · NEAR UXBRIDGE · MIDDLESEX

A VERSATILE PLASTIC

Polyvinyl Chloride: Some of its Applications in Aircraft Construction and Operation

IT was about twenty years ago that methods of softening and processing polyvinyl chloride were first discovered. During the past two decades tremendous strides have been made in the production of improved compounds and the development of new applications for this very important group of plastics. By varying the compounding materials and the type of resin, numerous combinations of desirable properties can be obtained.

The primary vinyl materials are made from carbide, chloride and hydrogen, and are produced in the form of fine white powders or milky fluids. These are processed by plastics manufacturers into a number of characteristic secondary forms from which, in turn, are produced a variety of articles used in the aircraft industry. P.V.C. can be calendered to produce thin, flexible sheeting; it can be applied as a coating to cloth or paper; it can be extruded to produce cable, wire or flexible tubing; and it can be moulded by injection processes.

Products made from P.V.C. have properties which are derived from the basic vinyl polymer. In general, they are extremely fire-resistant, practically non-ageing, and unaffected by ozone. They are also highly resistant to weather exposure, sunlight, most acids, alkalis, oils, and solvents, as well as to salt spray. They are resistant to abrasion and are not attacked in tropical climates.

In its plasticized form P.V.C. has varying degrees of flexibility, but it can be compounded without a plasticizer to produce rigid materials. Unplasticized P.V.C. possesses many of the properties of the flexible grades to an enhanced degree. Because of its high resistance to chemical attack, dimensional stability and good mechanical properties, it is replacing metals in many applications. It is easily moulded and can also be calendered into sheets or extruded into piping or conduit. Less than one-fifth as heavy as steel, it has a high strength-weight ratio, and its other attractions include permanence and low maintenance costs.

Apart from its low specific gravity, two of the most important properties of P.V.C. from the standpoint of employment in aircraft are low inflammability and low flame-spread. Although the material will soften under heat, unlike rubber it will not propagate flame. This property is illustrated in a recent test in which a piece of triple-core electric cable, insulated and sheathed with a Geon 101 composition, was suspended for ten minutes in a Bunsen flame at about 1,800 deg C. The conductor became red-hot, but the fire did not spread along the P.V.C. covering. This experiment clearly shows that, while P.V.C. insulation can be burned if very fierce heat is applied, it does not support combustion of its own accord. There is no spreading of the fire beyond the immediate influence of the applied flame.

Results of Fire Tests

A comparison of the flame-retardant properties of plastic-insulated and rubber-insulated electric cable was carried out at the Fire Research Station of the Joint Fire Research Organization on behalf of the British Plastics Federation. Part of the investigation related to the application of an external source of heat and was carried out substantially in accordance with the test specified by the Underwriters' Laboratories Inc. of America in their Standard for Thermo-Plastic Insulated Wires (3rd edition, March 1945). This test shows that plastic-insulated cables of the type tested have a greatly superior resistance to external heating than have corresponding rubber-insulated cables. All the plastic-insulated cables reached the standard flame-retardant properties as defined by Underwriters' Laboratories Inc., while all the comparable rubber-insulated specimens failed to reach this standard when subjected to the same test.

It follows that fire hazards in aircraft can be greatly reduced by using P.V.C.-covered cables and wires, passed through conduits constructed of rigid P.V.C. Though its resilience is not so great as that of rubber, the sheathing is tough and flexible and will stand up to most cable applications. An additional advantage in certain situations is its resistance to oil and grease.

Improved techniques have been developed for depositing vinyl materials on cloth, and P.V.C.-coated fabrics can now be very economically produced. The risk of fire can be further reduced by using materials made by applying P.V.C. to Fibreglass instead of to an ordinary cloth backing. Such coated fabrics have been officially approved for use in Service aircraft and are superior to many other kinds of synthetic seat-upholstery materials in their high degree of resistance to cracking, their excellent abrasion-resistance, and their exceedingly long life. Other advantages are that they are hygienic, can be washed with soap and water, do not scratch or stain readily, and are resistant to most acids as well as to grease and ink. They are obtainable in a variety of different colours—creams, reds, greens and blues—and also in multi-colour effects. These properties render them highly suitable for use as decorative coverings for walls, interior window frames and fairings. Cloth treated with P.V.C. can also be used in aircraft as a covering for wood or metal stands and tables.

For panelling their Comet, Argonaut and Hermes aircraft, B.O.A.C. specified vinyl leathercloth because it meets their requirements of toughness and high strength, combined with low weight, precise finish, consistency of colour, and low fire-hazard. An example of leathercloth approved by B.O.A.C. is Duranide, made with Geon P.V.C.

Rubber latex foam seating, as such, absorbs water. This tendency can be prevented by a two-coat treatment with a P.V.C. material. Two hundred and fifty foam seats, used with slip covers, were recently supplied for furnishing a Constellation order.

Tests of fire-resistant finishes for aircraft have been described.* A fireproof coating used experimentally as a sealant for fire walls, hot air ducts, electrical junction boxes and oil tanks consisted of a primer coat of Buna N base lacquer, a layer of putty, a wrapping of Fibreglass cloth, a second layer of putty, and a top coat of a Buna N lacquer applied after three days' curing to release all solvents. Disadvantages of this coating were excessive weight, complexity of application, and loss of adhesion at high temperatures. Paint-type coatings for less critical applications, such as plywood partitions, are designed to "puff" and form an insulating shield in the event of fire. A top coat of vinyl resin-base lacquer is applied over the fireproof paint to increase resistance to water and hydraulic oil.

A rigid vinyl sheet is used in B.E.A. Pionair Leopards, which are quickly adaptable for either passenger or freight work. For this dual function fitments must be strong and attractive. The sheeting is therefore specified for window coamings, bulkhead panels, kicking plates, luggage compartment and toilet linings, roof-trims and labels.

Pressure-Sealing Application

Cabin pressurization necessitates use of a special type of airtight bung when cables are passed through a pressure bulkhead. A suitable fitting has been produced in P.V.C. The holes through which the cables are passed are of a strictly controlled size and over these a P.V.C. membrane is moulded, this membrane being punctured just before the cable is passed through.

British Standard Sp.48, *Plastics Grommets for Aeronautical Purposes*, specifies requirements for the material, dimensions and finish of a range of grommets. The standard includes tests for the material from which the grommets are required to be manufactured, namely, plasticized P.V.C. or copolymers having vinyl chloride as their major constituent.

An interesting application in the United States is the use of a vinyl-coated fabric in the manufacture of a quickly erectable shelter for fighters. The shelter is designed primarily for use in the Arctic. It weighs 4,824 lb and will withstand a 70 m.p.h. wind and a snow-load of 30 lb/sq in. When erected, it provides enough room to house the largest type of fighter in use and gives sufficient working space for maintenance.

Also from the United States come reports of a special vinyl-proofed duck fabric which is placed beneath steel or aluminium landing mats to keep down dust on runways used by jet aircraft. Besides being flame-resistant, the coated duck is impervious to fuels and chemicals.

Foul-weather clothing made from fabrics impregnated with P.V.C. is replacing conventional oilskins in the Royal Navy. These lightweight P.V.C. "oilskins" are also very suitable for use by aircraft ground staff. They withstand prolonged exposure to fierce sun and Arctic frost, tropical storms, abrasion, oil and flame, and they can be stored away without deterioration.

The time cannot be far distant when the crews of aircraft will wear flying suits made from cotton impregnated with P.V.C., the fabric being completely encased. Suits of this material are as hard-wearing as those of the conventional type and can be produced at very much lower cost.

In both its flexible and rigid forms, P.V.C. is unquestionably making an important and timely contribution to the progress of the British aircraft industry. Yet this plastic is still a relatively new material, particularly in its rigid form. Research and development are still continuing. A.G.T.

**Jones, J. A., and Niswander, R. V. "A.S.T.M. Bulletin," 1950.*

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Air Whaling

IN your issue of November 20th you say that the factory ship *Norhval*, accompanied by ten catchers and three buoy-boats, and operating a W.S.55 helicopter, hopes to capture 15,500 blue whales in one season. You may recollect that, in 1947, *Balaena*, accompanied by ten catchers and two buoy-boats, and operating two Walruses, came back from the Antarctic with the second biggest catch of 2,615 whales of all sorts; well under half this number were blue whales. So I think it is rather overstating the helicopter case (which I agree is a particularly good one in whaling) to suggest that *Norhval* should be able to take so many more blue whales from the depleted whale populace of Antarctica.

As a matter of biological interest, you may care to note that the period of gestation for a blue whale is ten months, the length at birth 23ft, and it is forbidden by international regulation to shoot a "sprat" of less than 70ft length. This is the largest mammal in the world, weighing on average about 165 tons, and growing up to 95ft in length.

London, W.1. JOHN GRIERSON.

Prone Pilots

I WAS very interested in your article on the prone piloting position, as published in *Flight* of October 30th. It may be of interest to note that, in the U.S.A., the Aero-Medical Laboratory is closely following this subject and that, some years ago, this institute—housed at Wright Air Development Center—constructed a "dynamic human centrifuge," which was fitted with a prone-position bed. In this centrifuge, the pilot was not lying completely horizontal, but rather on his knees. Besides the F-80E mentioned in the article, a B-17 nose was fitted with a prone pilot position for experimental purposes. Results of these tests, however, have never been published.

Boskoop, Holland. HUGO HOOFTMAN.

Aircraft-assisted Take-off?

WITH the renewed interest in parasite aircraft such as the American B-36/RF-84F combination and the reported news that Russia's Tu-4 has been adapted to carry a Mig-15 under each wing for ferrying purposes, it occurs to me that the rôles might well be reversed.

The example in the historic Mayo composite of one aircraft assisting another to safety height could be followed by, say, two Folland Gnats under the wings of one of our future "heavies." With the added power, surely even an overloaded aircraft could be assisted off the ground in a shorter run and with a longer range guaranteed? After reaching safety height the "tugs" could then unhook and return for another take-off. This, to me, would seem to be more efficient, even if more expensive, than rocket assistance.

I merely wish to present the idea and to leave the working details to those whose job it is to consider such matters. However, I should be most interested to see if the scheme merits consideration by the savants.

Glasgow, S.3. A. R. FORBES.

U.S. Weather Ship Withdrawal

DURING the third I.C.A.O. Conference on North Atlantic Ocean Weather Stations, at Brighton, in July, the United States announced their intention of withdrawing three weather-ships; this decision caused concern among delegates representing other nations. The subsequent proposal, announced in October, that all fourteen U.S. ships, wholly maintaining four stations and partly maintaining two more, has caused much greater concern. On this side of the Atlantic, many excellent arguments support unanimous regret.

But the factor probably most important in the American decision has apparently not yet been mentioned. While the controversy rages, de Havilland Comets continue to increase both flying hours and reputation; the Americans continue trying to play-down these achievements and to prevaricate about Certificates of Airworthiness.

Turbojet aircraft are not usually troubled (except, of course, at take-off and landing) by the weather; they fly above it. The greatest asset of the type is speed, but fuel consumption is high; thus the upper-atmosphere jet streams, usually two or three times stronger than at the lower altitudes where the piston-engine types operate, are of fundamental importance to economy and safety. The present network of weather-ships is probably inadequate to supply the necessary information, for the streams are often very narrow; on the west-to-east journey time and fuel can be saved by "riding the winds"; on the east-to-west return, headwinds (which may reach velocities of 200 m.p.h. or more), must, if possible, be avoided. Adequate and accurate forecasts can allow diversions; failure to provide this service would necessitate fuel reserves which would seriously affect operating economy.

British aircraft, flown by pilots of a British airline, will operate the first turbojet service over the North Atlantic whatever the Americans say or do; but it should be interesting to see what next they can think up to put in the path of progress.

Cambridge. PEDANTICA.

Meteor Modification

IN a recent issue of *Flight* you disclosed that the Meteor 8 is to have a new cockpit canopy.

For a country as "hard-up" as ours is, the provision of rear view on an obsolescent aeroplane seems to me an extravagance; I suppose each "mod" will cost a couple of hundred pounds or more. At this rate we'll find afterburners in the Meteor's Derwents soon!

Farnborough, Hants. B. JAMES.

[Meteor 8s will be with us for a long time yet; and only the best equipment their pilots can be given is good enough.—ED.]

Insight

YOUR criticism in *Flight*, November 20th, 1953, of a book about night-fighter pilots quotes: "One crew reported after a sortie: 'We saw and destroyed a Ju52 full of night-fighter crews, shot up a train full of night-fighter crews going on leave. . .'"

These boys certainly developed night vision, and then some!

London, N.W.11. DONALD G. ROSS.

[Our correspondent has missed the point. The crews mentioned by the author of the book, *Cover of Darkness*, had been ordered to seek targets "directly concerned with the counter-offensive against enemy night defence"; the words quoted, from one of their subsequent reports, indicate their own reaction to these optimistically specific orders.—ED.]

Dakota and Rapide Replacement

IN most cases where an air route is successful, traffic is still increasing; moreover, successful or not, operating costs per aircraft mile are also, unfortunately, ever rising.

Thus the trend on replacement must be to use larger aircraft, and for most established operators, in the more civilized parts of the world, these already exist; e.g., the Rapide is naturally replaced by the Heron and the Dakota by the Viscount 801 or the Convair 340, if not by even larger aircraft. For opening new routes in undeveloped territory, the natural replacements seem to be the twin Pioneer and Bristol Freighter/Wayfarer respectively.

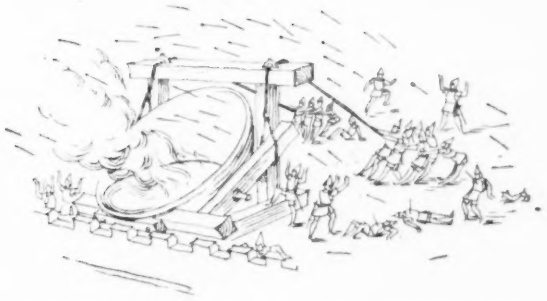
Two important cases remain. Firstly, where the Dakota itself has replaced the Rapide, and airfield size is now the limitation. In some cases, the Blackburn Universal might be the answer, but it is here that a really new design is required, and most of those proposed seem to fall short of the true requirements. My specification would be for an aircraft capable of carrying 40 to 50 tourist-class passengers or five tons of fairly bulky freight, and of being safely operated from a 1,000 yd grass strip irrespective of wind direction.

Maximum range would be 750 miles, most economical ranges 120 to 500 miles, cruising speed 220 to 240 kt, and stalling speed 70 kt.

My own guess as to the answer would be a large twin, with a wing loading not exceeding 50 lb/sq ft, and with Napier Nomads or Elands as alternative power plants. (The former might be attractive to avoid refuelling away from base in some cases, despite the weight penalty.)

Lastly, but not least, is the case of the impecunious operator who can neither afford the cost of large, new, aircraft nor the risk of snags in service all too often associated with a new type during its first year or so in regular airline use. Some may find the Heron sufficient for their traffic, whether formerly carried by Rapides, Dakotas or Consuls, etc.; but in most cases where Dakotas were bought cheaply another second-hand aircraft type seems the only feasible replacement—perhaps the DC-4s now being replaced by DC-6s on the major airlines, or later, by Convair 240s as these are succeeded by 340s or Viscounts.

Shenfield, Essex. J. RODGERS.



THE MARÉCHAL OF SHUTTLEDORE

"What happened," said the Maréchal, "to Exercise ML stroke BO? Don't tell me it was pigeon-holed!"

The Maréchal's counsellors looked towards their master, then at the ceiling, then at their feet.

"Well, come on!" said the Maréchal, "out with it!"

"Do you mean that idea of yours, milord, about molten lead and boiling oil?"

"Of course!"

"Well, sir, there were certain technical difficulties. We . . . er . . . that is . . ."

"Here we are, besieged, threatened daily, facing almost certain destruction at the hands of our enemies, and you talk of certain difficulties!"

"We lack the wherewithal, sir—the oil, the lead. We have only enough lead to tip our archers' arrows, only enough oil to grease their bow-strings."

"Do as I say!" the Maréchal thundered. "Erect a mighty cupola above the portcullis, fill it with molten lead and boiling oil, and destroy the enemy at the gate."

The counsellors retreated from the Maréchal's presence.

Six days later the enemy launched a new attack. As the blows of their battering ram echoed throughout the city, the Maréchal trembled.

"The molten lead!" he thundered, "The boiling oil! Destroy the invaders!"

The great basin containing the lead was slowly raised by block and tackle until it rested on the rampart above the portcullis.

"Now then!" cried the Maréchal, rubbing his hands, "let 'em have it!"

But, alas, as the Maréchal's men scrambled into their positions and prepared to tip the cupola, the sky began to rain arrows. The projectiles filled the air like a swarm of locusts and destroyed everything in their path.

"Aim at the enemy archers," roared the Maréchal.

"But we have no arrows, milord," said the captain of the gate.

And so the siege ended, with the fallen lying three deep around the cupola and the enemy battering their way unhindered through the massive portals.

"Someone," said the Maréchal, "ought to be hung, drawn and quartered for this."

And ten minutes later he was.

Folland Aircraft Limited, of Hamble, Hampshire, in their programme of research, design and prototype development, take into account national resources, man power, mobility and readiness for defence.

FOLLAND

I don't give two hoots for your Owl Patrol, said the M.D. testily. My little lot have won more badges for drilling in odd corners, screwing up the inscrutable, nut running, gun running, rum running and showing old ladies under buses . . . Good turns? Me newest tenderfoot does them at the rate of 1,000 a minute.* I am happy, nay proud, to be their dear old scout master —

'*Old master is right*', said a little horror in very long shorts. At least that's what we thought he said.

* The old boy seems to be referring to the latest Desoutter straight drill, a $\frac{1}{2}$" model weighing only half as much as other tools of similar capacity, with speeds of 1,000, 550 and 370 r.p.m.

'*Morse, of course*', *said the Little Horse.*

—•• / • / ••• / — — — / •• — / — / — / • / •— •

tools

put power into your hands

Desoutter Bros., Limited, The Hyde, Hendon, London, N.W.9. Telephone: Colindale 6346 (five lines) Telegrams: Despnuco, Hyde, London.

CRC 249

CORRESPONDENCE . . .

DC-3 History

AS one who has for many years made a special study on the history and development of the Douglas DC series transports, I was most interested to read Mr. Karl Larsson's paper *Replacing the DC-3*, an abstract of which was published in your issue of November 13th.

Whilst I am in agreement with the majority of DC-3 facts pointed out by Mr. Larsson in regard to the development of this transport, I am afraid I cannot agree with his suggestion that this remarkable aeroplane was *not* built for a specific purpose, but that *after* it was produced it became an "all-purpose aircraft" because of its unique superiority over all previous transport aircraft built (except the long-range flying-boats used for over-water routes). In the first place, I am surprised that Mr. Larsson has made no reference to the DC-3 being a direct development of its smaller "brother"—the much-proven DC-2. Before the first DC-3 flew, some 225 DC-2s were built in 1934-5, 138 of which went to the U.S. domestic airlines, the balance being sold to many famous airlines in Europe, Australia, South America and other countries.

Whilst credit for the principal specification which resulted in the DC-2 being built must go to Jack Frye (then T.W.A. vice-president) and his associates, together with A. E. Raymond (Mr. Douglas's chief engineer), Ed. F. Burton (chief designer) and John K. Northrop (then working for Mr. Douglas), proper credit for the specification which resulted in the larger and greatly improved DC-3 must go to American Airlines, Inc., who placed the first orders in late 1934, and who took delivery of the first seven built by the middle of 1936. The prototype first flew on December 22nd, 1935, and was, in fact, the first production model as well.

It was Wm. Littlewood (then chief engineer of American Airlines) assisted by M. G. ("Dan") Beard (then director of flight engineering) who, together with the top men at Douglas, got their slide rules working and gave us the original DC-3. Mr. Littlewood and Mr. Beard are still with American Airlines today, holding the positions of vice-president engineering and chief engineer respectively.

Aden. DENNIS M. POWELL.

FORTHCOMING EVENTS

Dec. 4. Helicopter Association: "Ground Resonance," by R. Howarth.
Dec. 4. Photogrammetric Society: "Stereoscopic Vision applied to Photogrammetry," by Professor W. D. Wright.
Dec. 5. British Interplanetary Society: Annual general meeting.
Dec. 9. Royal United Service Institution: "Effects on the Human Body of High-speed and High-altitude Flight," by G/C. W. K. Stewart, C.B.E., A.F.C., B.Sc., M.B., Ch.B.
Dec. 10. R.Ae.S. Main Lecture: "Training Devices for Aircrew," by C. B. Ringham and Dr. A. E. Cutler, B.Sc. (at Belfast).
Dec. 12. British Interplanetary Society: "Techniques of Protecting and Cooling Rocket Motor Walls," by H. Ziebland, A.M.I.Mech.E., Dpl.Ing.
Dec. 15. R.Ae.S. Section Lecture: "High-speed Wind Tunnels," by D. L. Ellis, B.Sc., A.R.T.C., F.R.Ae.S.
Dec. 15. R.Ae.C.: Film Show.
Dec. 15. Rochester Flying Club: Annual dinner and dance to celebrate 50th anniversary of powered controlled flight.
Dec. 17. R.Ae.S. Graduates' and Students' Section: Film Show (jointly with Inst. Pet.).
Dec. 17. R.Ae.C. and R.Ae.S.: Commemorative Dinner, 50th anniversary of Powered Controlled Flight.
Dec. 18-19. Institution of Production Engineers: Conference: "Problems of Aircraft Production" (at Southampton University).
Jan. 2. British Interplanetary Society: "Cosmic Radiation Hazards in Space Flight," by Dr. L. R. Shepherd, Ph.D.
Jan. 6. Institute of Metals: Informal discussion, "Lubricants for Non-ferrous Metal Working."
Jan. 7. R.Ae.S. Main Lecture: "The Fun of Finding Out in Flying," by Sir Leonard Bairstow, C.B.E., F.R.S., Hon.F.R.Ae.S.

R.Ae.S. Branch Fixtures (to Jan. 6).—Dec. 7, *Halton and Henlow* area meeting, "Design of Fast Load-carrying Aeroplanes," by D. H. Lee, F.R.Ae.S. Dec. 8, *Bristol*, "Fly-past, Present and Future," by Capt. J. Laurence Pritchard, hon. F.R.Ae.S.; *Henlow*, "The Training of Test Pilots," by G/C. S. Wroath, A.F.C. Dec. 9, *Manchester*, "Principles of Weight Control," by F. Howarth, A.F.R.Ae.S. Dec. 11, *Preston*, Wright Brothers' Jubilee dinner dance. Dec. 17, *Bristol*, celebration of 50th anniversary of powered flight. Dec. 18, *Birmingham*, films. Dec. 21, *Brough*, Wright Jubilee Dinner and film.

Jan. 4, *Bristol*, "Review of Developments in Aircraft Equipment," by G. H. Dowty. Jan. 6, *Belfast*, joint meeting with Queen's University Film Society; *Luton*, Wilbur Wright Centenary film.

IN BRIEF

Mr. K. G. de B. Hamnett, O.B.E., of 39a Butler Road, Seremban, Malaya, seeks information as to where and when aviation first started in Malaya. He knows that Keith-Davies and Peguet had a Bleriot in Allahabad and has been told that they may have taken it to Singapore; and he wonders whether there were any early balloon ascents in Malaya, possibly before 1900.

NORWAY'S AIRFIELD PROGRAMME

ABOUT a thousand men are now at work on the new Arctic airfield at Bodö in northern Norway. Though the airfield was opened for civil and military traffic last year, it will not be completed till 1955. With a main runway nearly two miles long, Bodö airfield is one of Norway's biggest, and will cost altogether £5m; it is included in the "infrastructure" programme.

Bodö is one of Norway's twelve airfields, of which five come into the "main" category and seven are regarded as "alternates." The main airfields, besides having to conform with N.A.T.O. condition for war-time use, must also be able to fulfil the requirements of the Norwegian Air Forces in peace-time. The others, designed for war purposes, have skeleton staffs.

Of the main sites, Rygge (near Moss, in south-east Norway), is expected to be completed by the middle of next year; it is an entirely new airfield. Gardermoen, in the east, was built by the Germans in the war, and extensive modernization has been necessary; it is hoped this will be completed within the next month or two. Sola-Forus (near Stavanger) is a military main airfield and a civil airport, and much of the work here—which can now be regarded as finished—is therefore financed by the Norwegians themselves. Vaernes (near Trondheim) is a main airfield now completed, and the remaining principal airfield is Bodö, referred to above.

The "alternate" airfields include Jarlsberg (near Larvik), begun before the war as a civil airfield and now being modernized for both civil and military use; Torp (S.-E. Norway), an entirely new site expected to be completed next year; Lista (in the south), an old field now being extensively modernized and expected to be ready by the middle of 1954; and Flesland (near Bergen), a new airfield which was included in the infrastructure programme this summer because of the decision to transfer Norway's main naval base from the Oslo Fiord in Eastern Norway to Mathopen, outside Bergen. The new naval base will be called Haakonsvern. Its airfield requires extensive levelling work which it is hoped to complete by the middle of next year.

The remaining minor fields are Orlandet (near Trondheim), originally built by the Germans, now being reconstructed and expected to be completed by the middle of 1954; Andoya (in Vesteralen, northern Norway), a new site on which work was started this summer for completion in 1955; and Bardufoss (northern Norway), originally built by the Germans and being reconstructed for use during the autumn of 1954.

FRESH FIELDS FOR G-AJOR

TWO out of B.E.A.'s original complement of three S-51 helicopters are being operated on advertising and other contracts in Germany by the newly created air division of R.M. Overseas Motors. In the accompanying photograph, G-AJOR is seen demonstrating outside the Henkel chemical factory prior to its departure on a publicity tour. Two members of B.E.A.'s staff will, it is understood, shortly be joining the new organization: Mr. John Crewdson as pilot, and Mr. W. Shippey as engineer.

"I thought my Vulcan was white, until . . ." The ex-B.E.A. helicopter, referred to above, in publicity service in Germany.

Accessory Drive by Air Turbine

Rotol Licensing Agreement with AiResearch of the U.S.A.: The First Application

UNTIL quite recently, direct mechanical operation, by shaft coupling to the main engine, has been the widely accepted method employed for engine-accessory driving. In some applications it will no doubt continue to be the method used, but in others an improvement is called for. Two factors make a change particularly desirable, namely, the increasing demands on electric power in modern aircraft and the wide differences between r.p.m. at take-off and cruise, and on the approach and landing, in the case of turbine power-units. In addition, the problem of positioning shaft-driven accessories becomes increasingly difficult.

Briefly, the requirement is for a constant-speed drive unit, and the air-turbine motor, deriving its motive force from a tapping from the main engine compressor and having an associated governor mechanism, is one method of meeting this requirement irrespective of the main engine operating condition. If a constant-speed drive is provided, alternator output is at a constant frequency, with resultant simplification of the aircraft electrical system. Additionally, if a number of separate alternators have to be driven independently at a constant speed they can operate in parallel. A second important advantage is that the installation of the turbine unit and gearbox is much easier, because a simple air duct replaces the auxiliary drive shaft.

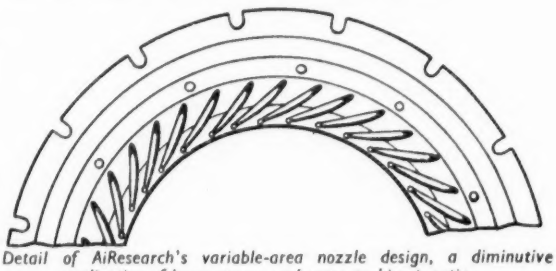
An incidental advantage which is nevertheless important is that in many cases a lighter installation can be achieved with air-turbine drive. Gearbox accessibility in flight is relatively simple to arrange should it be desirable.

A licensing agreement has recently been concluded with the AiResearch Division of the Garrett Corporation in America. It allows Rotol, Ltd., "to utilize the extensive and proved technique of AiResearch" in the design and development of Rotol air-turbine units. AiResearch are regarded as the leading producers of air-turbines (and a variety of other items) in America, although other companies in the United States—and at least one in England—are making a somewhat similar approach to the constant-speed drive requirement.

The American company state that they believe they were first in the field and that the idea originated from the application of large-turbine technique in the hydro-electrics industry. Their representatives are at present visiting the Rotol factory at Cheltenham Road, Gloucester, and we believe they have been impressed with what they have seen of the facilities and developments there.

First employment of the licensing agreement will be for a 100 h.p. Rotal accessory gearbox operating a 15 kVA alternator and a 3 kW generator. A fan is also driven, to cool not only the electrical accessories but the gearbox lubrication system as well.

The air-turbine motor driving these accessories is maintained at a constant speed by means of a pneumatically operated governor system. Rotol explain that this comprises a speed-sensing device connected to a servo actuator. The purpose of the actuator is to move variable-area nozzles (in operation, reminiscent of the iris diaphragm of a camera lens) to the correct setting to maintain constant r.p.m. They further point out that variable-area nozzles are an attractive feature of the design because they permit high turbine efficiencies to be maintained irrespective of the condition of the air supply from the engine. Air consumption is less than with a throttle-type control. A high degree of stability is achieved by the governing system and an over-speed cut-out is provided as a safety measure in the event of mal-functioning.



Detail of AiResearch's variable-area nozzle design, a diminutive application of large steam- and water-turbine practice.

An electrically operated air valve is fitted to the turbine inlet for starting and stopping and, in addition to its primary purposes, it serves as an automatic pressure-regulating valve. Pressure regulation is required when the aircraft is operating at low altitudes to limit the pressure of the air supplied to the turbine.

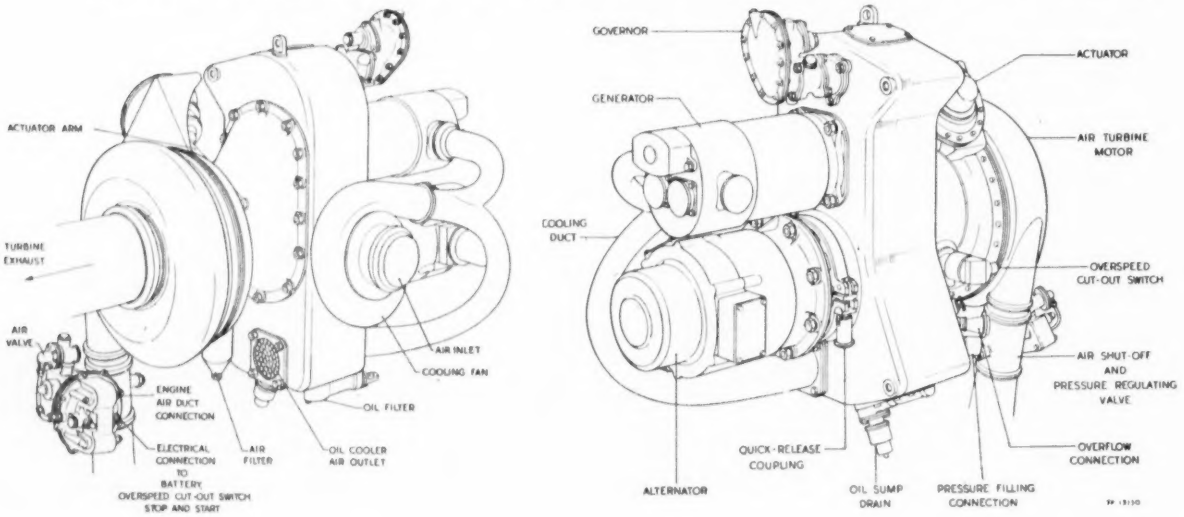
The accessory gearbox embodies an oil sump with dip-stick and the usual filling, overflow and drain plugs. Provision is made for negative-g conditions. The drives are pressure lubricated with the aid of a pump in the gearbox and the cooler for the oil is provided as an integral part of the sump.

After this first application of the air-turbine motor, Rotols plan to develop a range of air-turbine accessory drive units with powers of from 50 h.p. to over 100 h.p. This will be in addition to the accessory drive equipment with which they have hitherto been concerned and which now covers more than 150 different aircraft installations.

Although the first Rotol unit is particularly concerned with an alternator and a generator, air-turbine driven accessory gearboxes are suitable for use with other accessories in the same way as their shaft-driven counterparts. Rotol developments which will be announced next year will certainly include gearboxes with drives for a variety of accessories.

(See also references to air-turbine motors on page 726.)

Two views of the first Rotol air-turbine unit, to drive a 15 kva alternator and 3 kW generator. The unit has integral lubrication and cooling.



THE INDUSTRY

H. G. Nelson Joins Canadian Marconi Board

FOLLOWING a recent meeting of the directors of the Canadian Marconi Company, Mr. Stuart M. Finlayson (president) announced that Mr. H. G. Nelson had been asked to join the Board of the Canadian company.

Mr. Henry George Nelson, M.A. (Cantab), M.Inst.C.E., M.I.Mech.E., M.I.E.E., is deputy managing director of the English Electric Co., Ltd., and a director of Marconi's Wireless Telegraph Co., Ltd., the English Electric Valve Co., Ltd., and a number of other companies. He was, for two years, Outside Lecturer at Cambridge University's mechanical science tripos course on industrial management, and is active in trade associations. In addition to his distinguished academic career, he has served apprenticeships in France and Switzerland.

He was for seven years managing director of D. Napier and Son, Ltd.

English Electric recently acquired controlling interest in the Canadian Marconi Company, and Mr. Nelson's appointment will assist in furthering liaison between these two organizations.

A New Alloy Steel

WHAT would appear to be an important new metallurgical development with gas-turbine applications is indicated in an announcement made last week by the United Steel Companies, Limited.

In brief, the group's research department has evolved a new steel combining a tensile strength of 40 tons/sq in with favourable welding characteristics attributable to low carbon-content. The new material, which has been named Fortiweld, is also stated to possess good properties at 450-500 deg C, in which range it can withstand service stresses between two and three times those permissible for mild steel. It has already been successfully employed in the construction of gas-turbine welded-sheet-metal assemblies.

Recalling the "accidental" discovery of stainless steels by a metallurgist studying gun-barrel erosion during the 1914-18 war, the conception of Fortiweld was in some degree fortuitous. Describing the events that led up to it, United Steels say that during investigations of weldable steels their research department had produced many experimental materials, only to find confirmation that additions of the more commonly used alloys produced steels which, when they showed satisfactory mechanical properties, were generally difficult to weld.

Another problem, and one which did not seem to have any connection with this subject, was being studied at the same time. In an endeavour to improve the steel used in power-station steam pipes, experiments were made to determine the effects of a relatively little-used element, boron (which forms one of the main constituents of borax) on the properties of low-carbon molybdenum steel. Mr. W. E. Bardgett, research manager, discovered that, when molybdenum and boron were present in certain proportions, the yield-point of a low carbon steel was doubled without any necessity for heat treatment. As little as an ounce of boron, when added to a ton of steel containing 0.40 per cent of molybdenum, was sufficient to produce this pronounced and important improvement in strength. From this result as a starting-point the new material was developed.

The Dowty Year

THOUGH the aircraft side of the Dowty organization—whose annual general meeting was held at Cheltenham last week—has been affected to some extent by cuts in certain aircraft programmes, the output of aircraft equipment has reached a new high level. This news was contained in the statement by the chairman, Mr. G. H. Dowty, circulated in advance of the meeting. The chairman also announced that a new factory for the reconditioning of the company's aircraft products had been opened at Tewkesbury, Glos, and went on to mention that Dowty components were increasingly being used in aircraft of overseas design—so much so that export business during the past year was equivalent to 20 per cent of home sales.

Of associate companies abroad, Mr. Dowty said the Australian business had completed a profitable year's trading, and a small plant had been built outside Sydney; the activities of the Canadian company had been expanded by acquisition of the new factory at Ajax, Ontario; and favourable results had been reported from American concerns making Dowty Products under licence.

Of other companies in the group, there had been good progress by, among others, Dowty Seals, Ltd.—whose turnover had doubled—and Dowty Fuel Systems, Ltd.

Group profits were announced at £875,983—an increase of £315,972 over the previous year's figure—but taxation at £582,796 would require an additional £246,598.

IN BRIEF

The London office of Armstrong Siddeley Motors, Ltd., has been moved to Ormonde House, 26-27 St. James's Street, London, S.W.1 (Whitehall 7134).

* * *

Chamberlain Industries, Ltd., have appointed Electricals, Ltd., 14 Claremont Place, Newcastle-upon-Tyne, 2, as main distributors of their "Staffa" engineering equipment.

MR. R. A. SMITH has joined I.V. Pressure Controllers, Ltd., of Cranford, Middlesex, where he will be concerned with design and development of control valves and associated equipment for use in guided missiles. For the past seven years he has been engaged on research work at the R.A.E. Rocket Propulsion Department, Westcott. He is a Fellow of the British Interplanetary Society and a member of its Council.

F. J. Edwards, Ltd., 359-361 Euston Road, London, N.W.1, have issued an illustrated 52-page catalogue of their new and used machine tools in over 60 categories.

* * *

From Radiovisor Parent, Ltd., 1 Stanhope Street, London, N.W.1, come details of photo-electric equipment which, though primarily designed for the protection of personnel against dangerous electrical apparatus, is equally applicable to the guarding of machinery in general.

The Bristol branch of British Insulated Callender's Cables, Ltd., is now at 7-9 Barton Street; the telephone number (Bristol 23453-4) remains unchanged.

* * *

Birmid Industries, Ltd., announce a group profit, after all charges, of £550,987 (last year, £961,234); U.K. taxation takes £1,055,055.

* * *

Users of Hiduminium and Magnuminium alloys will find much practical information in a booklet of machining notes for these materials, issued by High Duty Alloys, Ltd., Slough, Bucks.

* * *

"Silicone rubber in industry" is the theme of an exhibition to be held by Midland Silicones, Ltd., at 19 Upper Brook Street, London, W.1 from December 2nd to 10th (10 a.m. to 6 p.m.; Saturday, 10 a.m. to 1 p.m.).

* * *

Wellworthy, Ltd., of Lymington, Hants, announce the establishment of area offices; in London, Mr. S. Amos is available at 2 Caxton Street, S.W.1 (Abbey 5579), and in Birmingham Mr. G. M. C. Hawke is at 36 Cannon Street (Midland 0570).

* * *

In order to give potential customers an opportunity to try new equipment in their own premises, the Atlas Diesel Co., Ltd., Beresford Avenue, Wembley, has put into service a demonstration van for carrying their range of engineers' tools to factories all over Great Britain.

* * *

In order to make available, as rapidly as possible, figures determined since the last edition of their data book on *The Nimonic Alloys*, Henry Wiggin and Co., Ltd. (Birmingham, 16) have issued a supplementary leaflet. Torsion properties of Nimonic 80A and Nimonic 90 have now been determined over the range 20-1,000 deg C, and more complete fatigue figures are available. Short-time creep tests on Nimonic 95 are included and new tables summarize recommended heat-treatments and acceptance creep-tests.

FAIRCHILD'S AIRLINER

Two Buried Turbojets Specified in a "Cusp-wing" Project

An artist's impression of the striking Fairchild project.

THE drawings on this page illustrate a jet-transport project by the Fairchild company's aircraft division. This novel design was revealed to representatives of 12 American domestic airlines on November 17th by the division's chief engineer, Mr. Walter Tydon.

Although it is at present no more than a project it is worth some comment, for it is the first modern American transport design to be freely published by the company responsible. Fairchild's president, Mr. Richard S. Boutelle, stated last June that a $1.5m research programme was under way; the first two results are this design—known as the M-186—and a turboprop military aircraft which is still secret, but is believed to be a delta-wing assault-transport. It may also be remembered that Fairchild unsuccessfully approached Avros in September with a view to acquiring that company's research data on delta-wing aircraft.

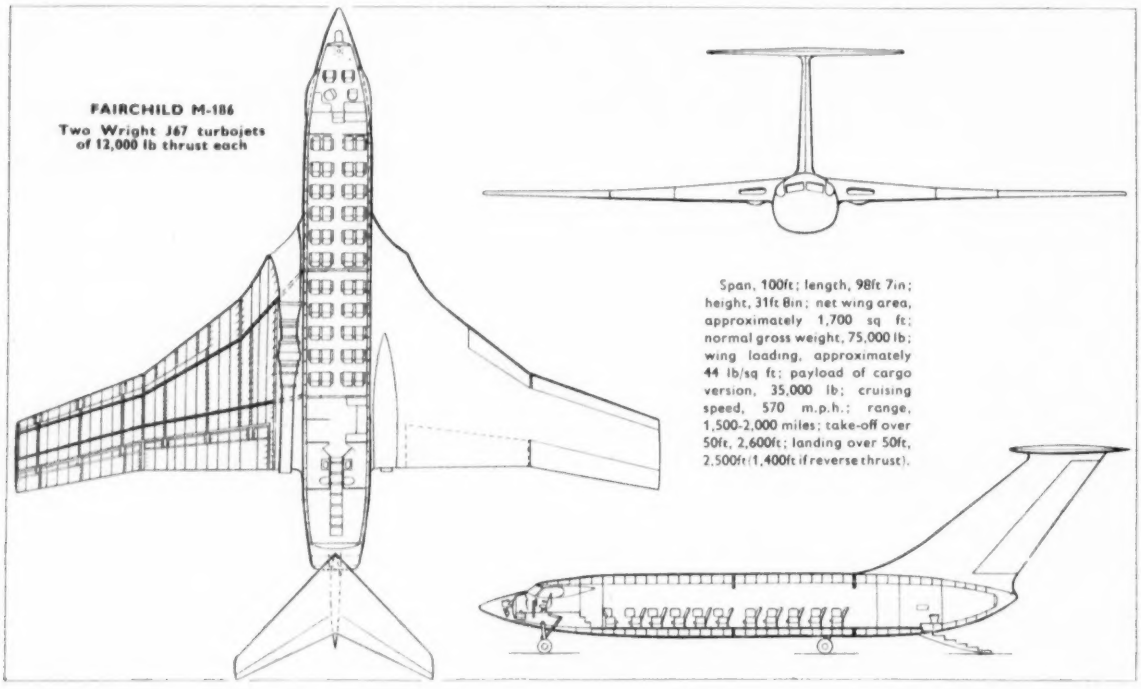
The Fairchild M-186 is a most provocative design. It differs radically from all other modern transports in several respects: it has a high wing, aft loading door and only two engines—and the engines are buried in the wing. The last feature is certainly worth noting, in view of what has been said and written in America to indicate that the buried engine is neither safe nor efficient.

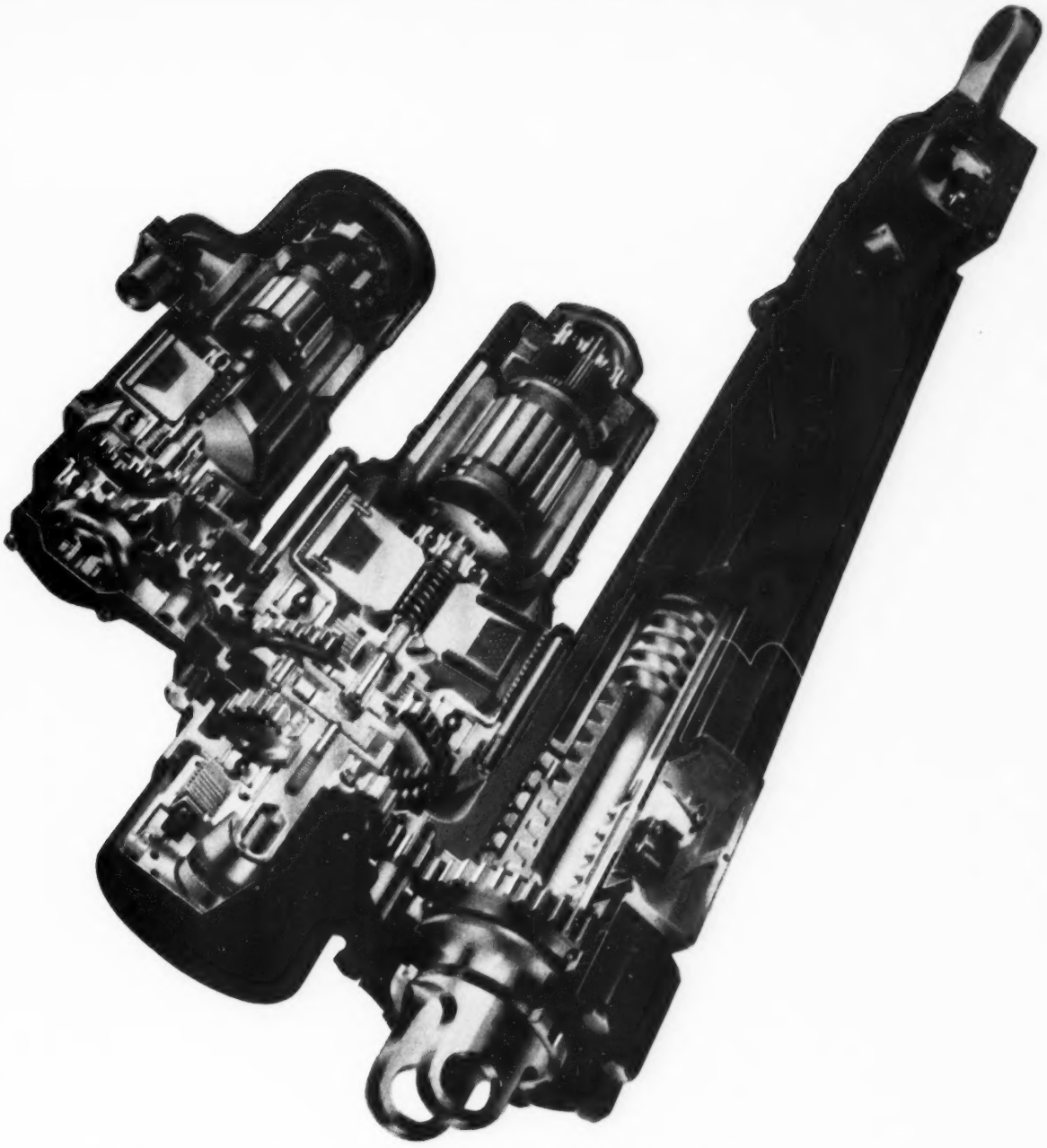
The power unit specified is the Wright J67 two-spool turbojet developed directly from the Bristol Olympus. It is, in fact, being developed in much the same manner as is the Bristol engine, and the thrust available is predicted as 12,000 lb minimum; but it is certain that no civil J67 will materialize for three years at least. Advantages of the J67 are its good fuel economy and light weight, which should more than make up for its high initial cost. The fuel will be wide-cut gasoline. There is to be provision for "Comet 3-type" external leading-edge tankage for later transcontinental versions of the aircraft.

The M-186 wing has a span of 100ft and a plan-form for which Fairchild use—not altogether accurately—the geometrical term "cusp." The character of this wing can clearly be seen in the drawing; it is a straight mixture of swept and delta forms in an exactly similar manner to that used in the A.S.T. high-speed target glider. The delta inner portion houses power units, fuel and main landing gear, while the thin outer sections are noteworthy for their leading-edge flaps. It is probable that, were no trailing-edge flaps fitted, the M-186 would be tailless. As it is, the inner wing has large split flaps and the tail is, as a consequence, reminiscent of that of the Javelin. For that matter, the wing layout parallels that of the Victor.

The drawing shows plainly the interior arrangement which, at a seat pitch of 40in and a gangway width of 17in, provides 44 seats—the same as the Comet Series 2. Up to 64 seats are foreseen in "coach" versions. In the rear are the galley and coat/baggage spaces, to starboard and port respectively, followed by two toilets further aft. Immediately in front of the passenger accommodation is a further baggage hold and a stewardess space, while the flight deck is laid out for two pilots, navigator and radio officer. All accommodation is well forward of the jet nozzles. Points of note are the "bubbles" on the canopy (*à la* Accountant) and the interior dimensions across the spar bulkheads—76in wide by 72in high; full width is 110in. The floor is 48in above ground.

Altogether the M-186 is well worth serious consideration. The aircraft would sell for $1.7m, assuming a production-run of 100. The data below is that published by Fairchild, except for the wing area and loading, which are our own estimates. The performance claimed is high; in practice we feel that the weight would be likely to rise well above the quoted figure.


FAIRCHILD M-186
Two Wright J67 turbojets of 12,000 lb thrust each
Span, 100ft; length, 98ft 7in; height, 31ft 8in; net wing area, approximately 1,700 sq ft; normal gross weight, 75,000 lb; wing loading, approximately 44 lb/sq ft; payload of cargo version, 35,000 lb; cruising speed, 570 m.p.h.; range, 1,500-2,000 miles; take-off over 50ft, 2,600ft; landing over 50ft, 2,500ft (1,400ft if reverse thrust).



This Rotax actuator is for heavy-duty applications, such as undercarriages, etc.

It is only one of the wide range of linear actuators, from 22 lb. to 20,000 lb. thrust.

Full technical information and advice available at all times.

Complete Electrical Systems for Aircraft

ROTAX

ROTAX LIMITED, WILLESDEN JUNCTION, LONDON, N.W.10.

Lucas-Rotax (Australia) Pty. Ltd., Melbourne, N.3., Australia.
Lucas-Rotax Ltd., Scarborough, Ontario, Canada.

G.E.C. FOUR UNIT

Obstruction lights

This new G.E.C. Four Unit Obstruction fitting has been specially designed for use on high chimneys to indicate this danger to approaching aircraft. Three to four fittings are employed, one lamp in each being illuminated at one time. When a lamp fails, the next one is switched on until all four lamps have been used.

Control is by means of separate rotary switches at the base of the chimney.

Transformers are employed to supply a reduced voltage to ensure maximum lamp life within I.C.A.O. requirements for light output.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

CIVIL AVIATION

TRANSATLANTIC TERMINAL: Prestwick's importance as a military staging-point, as well as its commercial rôle, is illustrated by this recent view from the control tower. The DC-6B of S.A.S. is taking on passengers for the final part of its journey from New York to Copenhagen and Stockholm; the Coastal Command Shackleton MR2 is taxying in after completing escort duties during the recent Royal flight. "Flight" photograph

V.I.P. VISCOUNTS FOR INDIA

IT was announced last week that the Indian Government have ordered two Viscounts for delivery in the summer of 1955, bringing to 86 the number of these aircraft which have now been sold or ordered. Other orders are, of course, under negotiation. Both machines will be operated by the Communications Squadron of the Indian Air Force and will be stationed at Palan, near Delhi. They will be the first to enter service with the improved Darts giving an extra 80-90 h.p. per engine under cruising conditions and a better all-round performance. One aircraft, designated Type 730, will be a lavishly equipped personal transport for the President and will also be used by the Prime Minister. The forward part of the fuselage will contain a saloon and rest chamber furnished with two beds, separated by a bulkhead from a conference room with a six-place table and sofa. An aft compartment will have seats for ten officials. The other Indian Air Force Viscount will be a 40-seater for use of members of the Government and senior officials.

PRESTWICK AND ITS PROBLEMS

IN commemoration of the 13th anniversary of transatlantic air services to Prestwick Airport, the now-customary dinner was held there on November 28th by Scottish Aviation, Ltd. This event has achieved red-letter status in the British aviation calendar, not only because it honours a great step forward in the progress of air transport, but because of the unique opportunity it affords to the Englishman of renewing contact with so many leading personalities at this hub of Scottish aeronautical activity.

The ownership of Prestwick was for several years at the heart of a major issue affecting the future of the airport—which, it will be remembered, was requisitioned by the Government at the beginning of the war. Scottish Aviation's claims for compensation were disputed by M.C.A. and no settlement was in sight until last year's dinner, when Mr. Lennox-Boyd announced that an arbiter would decide the case. Although the terms of compensation have not been revealed, the dispute is evidently at an end. On Saturday, the Duke of Hamilton and Brandon, chairman of Scottish Aviation, paid tribute to Mr. Lennox-Boyd for ending the deadlock. His Grace was speaking on "The Occasion," and he hinted that it was not one for unqualified rejoicing. There were indications that Prestwick's traffic might decrease. The future of Prestwick, he urged, was a national problem and not merely a side issue.

For those who are not entirely familiar with the Prestwick problem, it should be interpolated that it is one of much longer standing than the Gatwick problem, and differs in almost every respect. It is largely the story of people who want a major domestic and international airport but have so far been denied one. Although Governmentally recognized as Britain's No. 2 airport, Prestwick has not become the great terminal envisaged by many of its supporters. The situation was summed up by an excellent leader in last Friday's *Scotsman*, which referred to Prestwick's "nominal status as the second international airport" and concluded, sadly but realistically, that "It may serve as a convenient refuge for planes diverted from fog-bound aerodromes and it may be kept on a care-and-maintenance basis for defence purposes, but the bright vision of Prestwick becoming an air junction with the prestige that the Clyde enjoyed in shipping has faded, perhaps beyond recovery."

Next spring work will begin on Prestwick's new runway, which should eventually make the airport suitable for the largest transport aircraft under virtually all wind conditions. The Central Committee of the Scottish Chambers of Commerce, one of the strongest voices raised in the defence of Prestwick, has said flatly that the construction of this runway will be a waste of money unless there is an increase in traffic. The committee would like to see Prestwick take over from Renfrew as the focus for Scottish feeder services. To counteract the argument that Renfrew is some 25 miles nearer the Glasgow city-centre, the committee points to Prestwick's weather characteristics and says that the surface-transport problem could be offset by an improved railway system from Glasgow to Ayr and by the reduced flying time on journeys to the south.

Recent despondency as to Prestwick's future results largely from the inauguration of Sabena's transatlantic service from Ringway to New York, with the prospect of a new B.O.A.C. Stratocruiser service also calling at Ringway. But whatever the respective merits of Ringway and Prestwick it is impossible to escape the logic of Mr. Lennox-Boyd's dictum, expressed at the 1952 Prestwick dinner, that the question of airport development is eventually settled by the passenger.

Unless the amount of local traffic available to the airlines using Prestwick is increased it is impossible to foresee any significant change in its present status, even though (to quote G/C. D. F. McIntyre, managing director of Scottish Aviation) "it is the safest and finest and most natural airport on this side of the Atlantic." He described the choice of Renfrew as the domestic terminal as "a most extraordinary thing," notwithstanding the views of the Scottish Air Transport Advisory Council and its chairman, "the aviation oracle in this part of the world."

Before proposing the toast of British air transport G/C. McIntyre added that the dinner might be the last opportunity to say how much they had appreciated the wonderful change in relationship between the company and the M.C.A. in the last two years. In the absence of Mr. Lennox-Boyd, who returned from a holiday in Sicily just too late to attend the dinner, Mr. Profumo, the Parliamentary Secretary, replied with a few diplomatically chosen remarks about the independent companies' contribution to air transport progress in general, and the part played by Scotland in particular. Prestwick, he noted, had handled 16 per cent more passengers in 1953 than last year.

On the subject of possible improvements to Scotland's network of air services, Mr. Profumo was cautious. The Government, he said, had a natural desire to expand on those routes which B.E.A. regarded as unremunerative, but the Ministry could not insist on the operation of services which would add to the Corporation's deficit. When he spoke of the need for an aircraft possessing low operating costs and capable of serving outlying points with no prepared airports, and thus having exceptional take-off and landing performance, we naturally expected some announcement concerning the Scottish Aviation Twin Pioneer. However, it was left to Mr. I. Henderson Stewart, Joint Parliamentary Under-Secretary of State for Scotland, to announce that the Government were considering this aircraft with the greatest sympathy; he hoped that there would soon be an answer for G/C. McIntyre.

We learned from Scottish Aviation of the world-wide interest which was evoked by the announcement of this aircraft last year. The company's chief test pilot, Mr. N. J. Capper, has just returned from Malaya where the first four of a sizeable batch of "single" Pioneers (photo on page 744) are in service with the R.A.F. By employing the same wings, slats and flaps, the twin Leonides, 16-seat Twin Pioneer will be able to offer a unique small-field performance. Most of the design work is already completed, together with a mock-up, and construction of the first prototype is due to begin in two or three weeks—whether or not Ministry of Supply backing is obtained. By the use of simple construction methods Scottish hope to keep the price down to £35,000. If all goes according to plan the first Twin Pioneer should appear at Farnborough next year and the company is confident that production orders will follow very soon afterwards. G/C. McIntyre believes that on a cost basis the helicopter will never be able to compete with this type of fixed-wing airliner and that the demand for the Twin Pioneer, once it has proved itself, will continue for at least 10 years.

CIVIL AVIATION . . .

INDEPENDENT NETWORK

TO refer to a privately owned air-transport firm as a charter company is not only unfashionable, but in most cases inaccurate—as indicated by the 1952-53 report of the British Independent Air Transport Association. This informative document, reviewed briefly in the previous issue of *Flight*, records that 149,259 passengers flew on scheduled services operated by British independent airlines during the 12-month period ended June 30th, 1953. In 1951-52, the corresponding figure was 68,078.

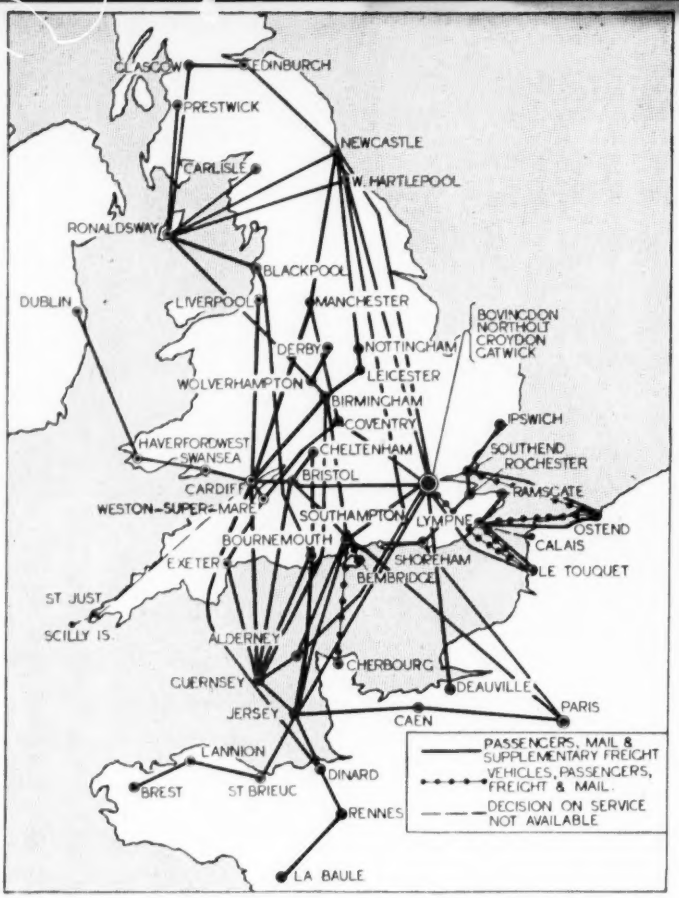
This substantial increase has apparently been achieved without stunting the growth of the Corporations' passenger traffic. The Government can therefore claim that its policy of simultaneously protecting the Corporations and encouraging the independents has proved reasonably successful. However, the chairman of B.I.A.T.A., in his address at the Association's annual dinner, reminded his audience that "Most of our progress must be considered in relation to our earliest precarious existence . . . although conditions are better, we are by no means sailing in sheltered waters." A. Cdre. Powell added that some of today's financing and fleet problems were "relatively worse than the earlier struggles for survival."

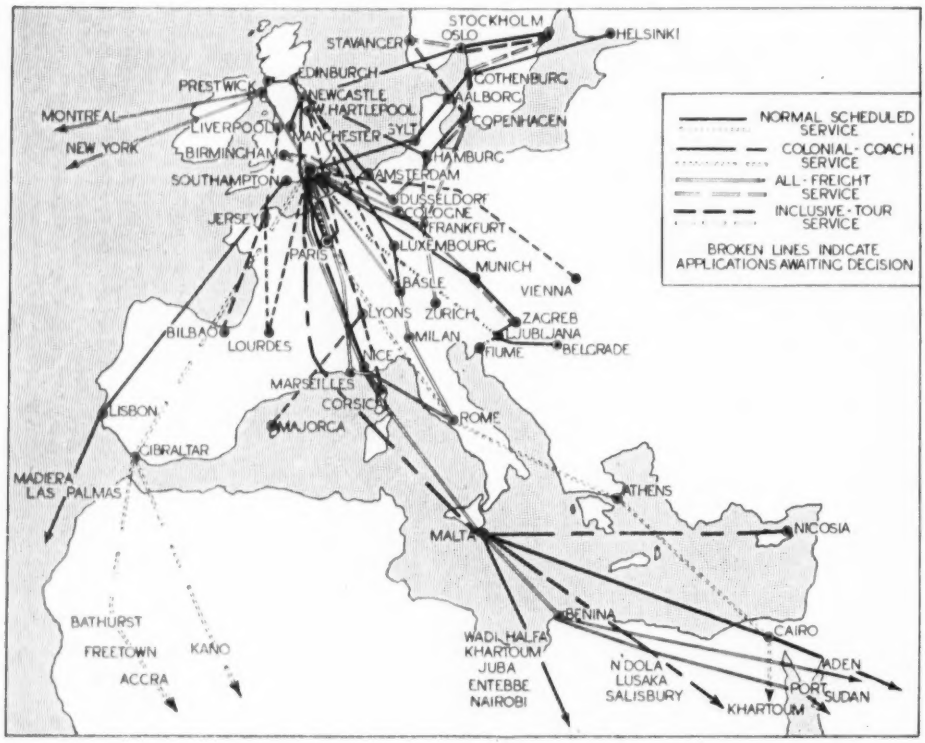
Re-equipment problems are underlined by the fact that independent companies have been approved to operate 14 all-freight services—to points in Europe, the Middle East, Canada and America—but that none of these services has yet been inaugurated. Stressing that freight development will be slow until the right types of aircraft become available, the report voices a fear that the "built-in economics" of such aircraft will be nullified by steady increases in labour costs, materials, landing fees and other overhead expenses.

The B.I.A.T.A. report also remarks that the future envisaged for Colonial Coach services (operated at fares about 40 per cent below first-class rates) has not yet materialized to any extent. It urges that, on those Commonwealth routes where there is little foreign competition, the potential is so great that there is room for more than one British operator and certainly room for three classes of service. Of 25 applications for Colonial Coach services submitted by the independent companies, 18 were rejected. B.I.A.T.A. states that, in opposing these applications, the Corporations seem to have been more nervous than they need to have been—"particularly in view of the established precedent on the Nairobi route, where all classes of services have prospered and unhealthy competition has not developed."

The report includes maps — reproduced on this page—showing both domestic and overseas routes operated by independent airlines, together with routes for which application has been made but not yet finally approved. Despite this impressive growth in the scope of the independents' scheduled operations, it may be noted that, on a ton-mile basis, non-scheduled flights still account for eight times as much traffic as regular flights. Trooping is the largest single type of contract or charter operation undertaken by the independents; 88,285 Servicemen or members of their families flew in independent aircraft during the period reviewed.

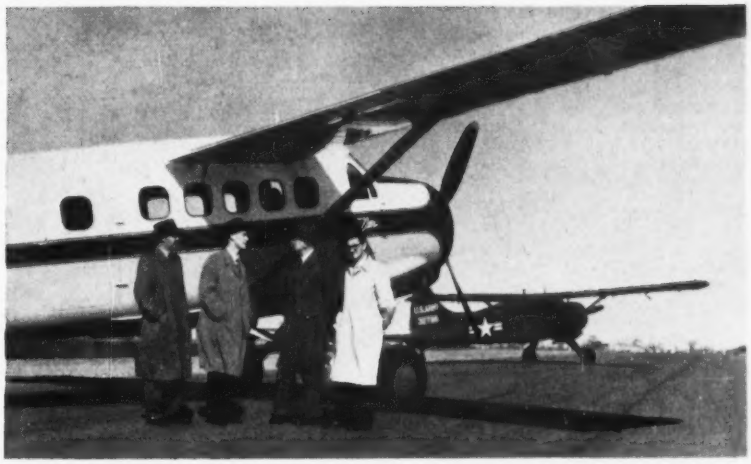
On the subject of inclusive tours, which B.I.A.T.A. regard as "a pure charter operation and thus . . . the domain of the independent operator," the report observes that the Government's insistence on treating tours as scheduled services has resulted in many economic penalties. Tours are submitted to a large number of scheduled-service operational and commercial regulations which, it is claimed, produce a severe rise in costs and rates.





Domestic and overseas route-patterns approved for operation by independents, together with routes for which applications have been made to the A.T.A.C. These maps are from the annual report of B.I.A.T.A.

MISSIONARY SEALAND: The Christian Missionary Alliance of New York has taken delivery of a Short Sealand for work in the East. Alliance members seen here are: Mr. A. Lewis, pilot; Mr. E. W. Ulrich; and the Rev. B. S. King.



BOTH OTTER AND BEAVER (an L-20 version of which is in the background) were demonstrated to the Argentine Ambassador to Canada recently at the de Havilland Canada factory, Toronto. There are now 32 Beavers in service with South American countries. Pictured above (left to right) are Mr. Kettles, Massey-Harris; Dr. L. Galiguiana, the Ambassador; Mr. P. C. Garratt, managing director of de Havilland Canada; and Mr. J. Ayestaran, the Ambassador's first secretary.

T.A.A. BORROW A DC-6

THE forthcoming Royal tour of Australia is already reported to have caused a large increase in bookings on domestic airline services. To supplement their fleet of Convairs, DC-4s and Dakotas, Trans-Australia Airlines have recently signed a long-term contract with K.L.M. for the charter of one of the Dutch airline's 50-seat DC-6s. As from December 14th this aircraft will operate on T.A.A. routes under K.L.M. command, wearing an Australian registration and carrying both T.A.A. and K.L.M. crew-members. The period covered by the contract is not stated but the DC-6 will presumably remain in Australia until T.A.A.'s Viscounts (the first of which is due for delivery next June) are ready to enter service. T.A.A.'s rival, the privately owned Australian National Airways, are also introducing the DC-6 this month, having recently bought two from an American operator.

K.L.M. ROUND-UP

RECENT announcements from the K.L.M. headquarters in The Hague emphasize the variety of work undertaken by this old-established airline. The company's survey division, which operates under the name of K.L.M. Aerocarto, is at present engaged on the aerial mapping of a 9,000 sq mile region in Syria. Last year six contracts of this type were executed in Syria and four more in Iraq.

On November 13th K.L.M. completed their 3,000th charter from New York to Hamburg with 36 seamen. Of this total of special flights, just over 2,500 have been made in the post-war years at an average rate of six per week.

The airline's long-range freighting fleet was strengthened by the arrival at Schiphol on November 16th of the second of two DC-6A Liftmasters ordered from Douglas. The first of these, it will be remembered, won the transport handicap section of the New Zealand Race. These aircraft, which can carry up to 11 tons of cargo each, are being operated mainly on the North Atlantic route. It is announced that Super Constellations, which have also recently entered service with K.L.M., will make their debut on the Amsterdam-Tokyo route on January 5th, 1954.

There was an increase of 17 per cent in K.L.M.'s passenger traffic during the first nine months of 1953, by comparison with the corresponding period of 1952. The number carried was 470,000, as against 401,000. Last year the number of passengers carried by the airline did not reach the half-million mark until the second half of December, whereas the 500,000th K.L.M. passenger of 1953 travelled in the middle of October. During the period January to September this year K.L.M.'s aircraft carried 10,150 tons of freight, 9,250 tons of baggage and 1,600 tons of mail.

ALL-FREIGHT LINES' PROBLEMS

AMERICA'S two scheduled all-freight airlines, Slick Airways and the Flying Tiger Line, have encountered considerable opposition to their attempt to obtain C.A.B. permission for a merger. Mr. F. H. McAdams, counsel for the C.A.B.'s Air Operations Bureau, is reported as saying that the two companies had not proved that by merging they would benefit the public interest. He claimed that the capital structure of the merging companies would be unsound, although a special examiner, Mr. F. Ruhlen, has stated that the company's economics would be improved considerably and has recommended to the C.A.B. that the companies should be permitted to merge. United Air Lines and American Airlines are prominent among the large carriers objecting to the merger.

For some time both Slick and the Flying Tiger Line have been seeking an increase in minimum freight rates in order to prevent undercutting by subsidized or more powerful rivals. These efforts recently proved successful; on November 20th a 25 per cent increase in minimum charges came into effect. New minimum rates are 1s 5d for each of the first 1,000 ton-miles and 1s 1½d for each additional ton-mile. American observers do not expect serious effects on traffic, since most rates were at least 10 per cent above the old minimum.

INITIATIVE

A RECENT issue of *Flagship News*, the house journal of American Airlines, tells a remarkable story of enthusiasm on the part of a 23-year-old ground-staff employee at La Guardia Airport. The man concerned, Dick Franke, was taught to fly at a friend's expense in May 1952. Within twelve months, flying only in his spare time, he had logged the astonishing total of 750 hours. To overcome the problem of paying £3 per hour for aircraft-hire, Franke and another private pilot bought their own machine for £530. This was sold after Franke had gained his private pilot's licence and commercial licence with instrument rating. He has since graduated to a twin-engined Beechcraft and, having passed the necessary written tests, expects to receive a multi-engined endorsement shortly. His next ambition is to graduate to one of American Airlines' flight training classes for co-pilots.

TRAFFIC CONTROLLERS' GUILD

IN September last year, at a meeting held in Londonderry House, a group of air-traffic control officers made the decision to form a professional guild. Temporary committees were set up to prepare the constitution, objects and ordinances of the association. A further meeting on November 14th approved the committees' proposals, and the Guild of Air Traffic Control Officers is now being formed. The chairman is Mr. C. A. Robinson, A.F.R.Ae.S.

A letter from the secretary, Mr. W. C. Woodruff, describes the objects of the guild and reports progress to date in the following terms:

"Very briefly, our objects are to promote the practice of the profession of Air Traffic Control and to maintain its efficiency for the benefit of all those who seek their livelihood or pleasure in the air. The Guild is being formed along the lines of existing guilds and city companies. The first Court of the Guild will be elected in the New Year.

" We have nearly 300 founder members drawn from the Royal Navy, the Royal Air Force, the Ministry of Transport and Civil Aviation, the Channel Islands, the Isle of Man, International Aeradio, Ltd., and a number of other authorities who employ air traffic control officers.

"Membership is limited at present to British subjects who have

ROYAL TRANSIT-STOP: H.M. the Queen and H.R.H. the Duke of Edinburgh disembark from the B.O.A.C. Stratocruiser "Canopus" at Kindley Field, Bermuda. The aircraft later carried the Royal party on to Jamaica, returning to London on Saturday. On Tuesday Sir Winston Churchill was due to leave for Bermuda in the same machine.

CIVIL AVIATION . . .

the requisite qualifications, but contact has been established with other countries with a view to the exchange of information with similar bodies there. As soon as the first Court of the Guild is elected we shall be accepting further members."

Mr. Woodruff's address is 1, The Grove, Ickenham, Uxbridge, Middlesex.

VISCOUNTS PAY THEIR WAY

SOME remarkable B.E.A. operating statistics for the Viscount during its first 4½ months of airline operation were published last week. Up to the end of August the fleet had earned £963,000, of which £212,000 was profit. Average revenue load factor was 71.4 per cent, contrasting with a break-even load factor (total costs) of only 55 per cent. Viscounts had carried 42,000 passengers over an average stage-distance of 635 miles at 231 m.p.h.

Passenger preference for the Viscount has been shown by traffic results on the routes operated by these aircraft during the period concerned—London to Istanbul, Cyprus, Zurich, Geneva, Copenhagen and Stockholm. Following the introduction of the turboprop airliner, B.E.A.'s share of the Zurich traffic rose from a summer average of 25 per cent to over 40 per cent in the first two months and has since been maintained at this level. On the Geneva route the Viscount increased B.E.A.'s share of traffic from 20-25 per cent to 53 per cent by June; the average percentage gain on the Scandinavian route has been 12 per cent, and on the Istanbul service approximately 18 per cent more passenger traffic has gone to B.E.A. since the Viscount came into service. On all routes the average gain to B.E.A. has been 16½ per cent. The Corporation now has 12 Viscounts in service on nine routes.

These provisional figures are based on an average fleet of only about half the present strength, and results have been maintained or improved since the end of August. We estimate that the profit earned by Viscounts, for example, is now nearer £400,000, and that the break-even load factor on direct costs is not much more than 25 per cent.

SILVER CITY FINED

A COURT case in London on November 27th was the sequel to a forced landing early this year by a Silver City Airways Freighter. The aircraft, piloted by Capt. D. S. Flett, took off from Berlin on January 19th to fly to Hamburg; it could not land there or at the alternative, Bremen, because of bad weather and returned to Berlin. It was held over Berlin and ran out of fuel while waiting to land; both pilot and radio operator were injured when the Freighter descended on a railway line in the Russian zone. On a summons that the person in command failed to satisfy himself that the aircraft flew with sufficient fuel, including a safe margin for contingencies, Silver City Airways, Ltd., were fined £200 with 40gn costs, and Capt. Flett was fined £50; on a further summons, for not carrying a second pilot, the owners and captain of the aircraft were fined, respectively, £20 and £10.

CLUB AND GLIDING NEWS

A MOST interesting and useful "gen session" was held at Dunstable last Saturday, when the London Gliding Club's successful entrants in this year's national gliding championships spoke of their flights, hopes and mistakes during the eight-day contest. The team's discussion was chaired in effective manner by Alan Yates.

After a brief account of some general aspects of contest flying by Geoffrey Stephenson (national champion), members of the team gave a day-by-day description of their flights during the nationals. Geoffrey Stephenson, Dan Smith and Frank Foster had entered for the individual section, and Godfrey Lee with Charles Ellis, and Alan Yates with Geoffrey Nixon for the team section. Among the flights described was that by Godfrey Lee from Great Hucklow to Marham, begun after waiting and soaring above the Derbyshire site for 4½ hours. The whole flight lasted for almost eight hours, and the distance covered was 105 miles.

The out-and-return race to Rearsby on the sixth day of the contest provided the incredibly well-judged final glide-in by Philip Wills, the only competitor to complete the course. The difficult conditions on the return leg were described by Foster, Nixon and "Steve," who himself landed only 3½ miles short of Great Hucklow.

On the final day, flights were towards Lympne (193 miles). The only pilot to reach this goal was Steve, in a brilliant six-hour flight which he himself described as the high-spot in his gliding career. The interesting and variable nature of the weather conditions on this day were emphasized by the accounts of Foster (who reached Buntingford on a second attempt), Smith (who reached Colchester) and Ellis (who reached Southend).

Summing up, the chairman mentioned the championship results: Stephenson with a clear lead of 89 points, and next Dan Smith, Philip Wills and Frank Foster with only two points separating their scores. In the team class, Lee and Ellis were runners-up to the E.T.P.S. team, with Yates and Nixon third. Winning ten of the contest's 16 awards, the club had indeed put up a fine show.

Following the discussion, films taken at Great Hucklow and at last year's international championships in Spain were shown by John Furlong.

* * *

MARGINAL conditions of visibility, in spite of a warm sun, restricted the activity at the lunch patrol organized by the Denham Flying Club on Sunday last. Five defending aircraft were airborne, and six visitors (four from Elstree, one Redhill and one Thame) managed to find Denham in the murk; only one aircraft arrived unspotted, nevertheless all visitors received free lunches. During fog which descended during the patrol, the crew of one of the Denham Magisters lost sight of the airfield and, after flying through very thick fog for some time, landed the aircraft in a field near St. Albans. The two occupants were Miss Janet Ferguson and her mother Mrs. L. M. Ferguson. All six attacking aircraft were forced to stay at Denham overnight due to the fog.

Sunday's fog was also believed to be the cause of a regrettable accident to the occupants of a Magister of the Redhill Flying Club, who had taken off from Redhill to examine weather conditions before deciding whether to fly to Denham for the lunch patrol. The aircraft came down in a garden at Nutfield, near Redhill, during the fog, and the two occupants were killed. They were Mr. Robert Holmes and Mr. A. W. Webster, both members of the Redhill Club.

* * *

TO CELEBRATE the 50th anniversary of powered flight, the annual dinner and dance of the Rochester Flying Club will be held this year on Tuesday, December 15th. The venue will be the Tudor House, Bearsted, and the time, 8.30 p.m. to 2 a.m. Further details may be obtained from the club at the airport, Rochester.

* * *

A TOTAL of 2,000 pilot licences were issued in France during the first ten months of this year, according to figures published by the French Ministry of Aviation. The Ministry said there were now 227 private flying clubs in France and the Overseas Territories.

* * *

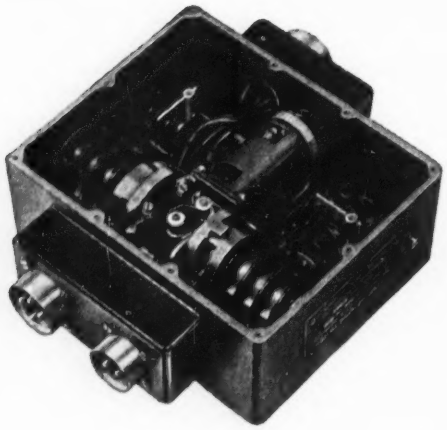
FLYING hours for the Wiltshire Flying Club during September and October amounted to 621, bringing the year's total to 2,408. From June to November, 29 P.P.L.s were obtained, and three club members are completing the course for the Junior Commercial Pilot's Licence. Short night-flying courses have been carried out, and a night-flying programme is flown at Thruxton every Monday and Wednesday, weather permitting.

FLYING TROOPSHIP

The largest single customer of Airwork's fleet is undoubtedly the Air Ministry which uses the Company's Hermes aircraft for transporting troops to and from the Canal Zone, Nairobi and West Africa. In addition the Ministry employs Airwork Vikings based in Egypt and Malta to provide regular local services in the Mediterranean area. Airwork was responsible for initiating the idea of air trooping and for several years has played an increasingly large part in developing this method of carrying out routine troop movements.

It is experience of this nature which enables Airwork to contribute so much to the efficiency and reliability of the new Safari Service, the first public air line to be operated by private enterprise since pre-war days.

AIRWORK
LIMITED
AIR TRANSPORT DIVISION
15 CHESTERFIELD STREET · LONDON · W.1



CYCLIC DE-ICING SWITCH

by

Teddington

This switch is designed to operate a 3 phase 400 cycles supply and is capable of carrying a load of 22 amps. on 208 volts.

It directs the supply in a controlled time sequence to de-icing installations on the propeller spinners and air intakes of turbo-propeller engines.

The switching unit employs a bank of cams driven by a two-speed governed motor through an 18,000 : 1 reduction gear box. The motor operates on 24 volts D.C. nominal.

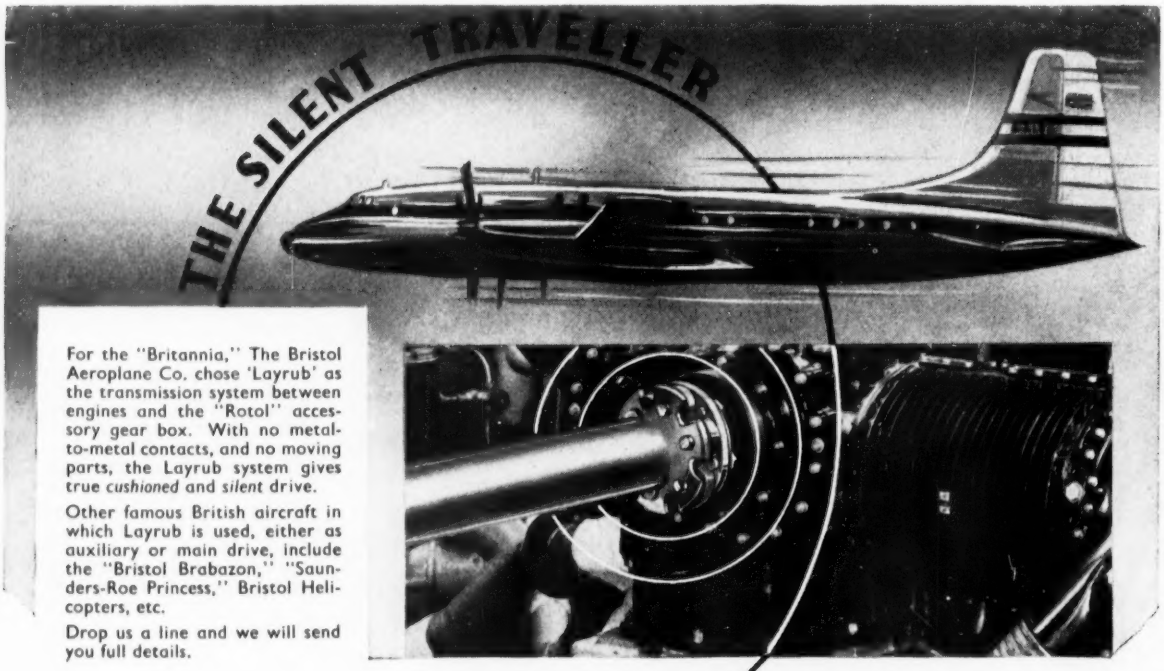
SPECIFICATION

Switching Sequence.
High speed: full cycle 120 secs.
Propeller and Spinner on 30 secs.
off 90 secs.
Air Intakes on 20 secs.
off 40 secs.
5 secs. interswitching delay.
Slow speeds: Triple above times.

Loading: Will carry 22 amps (non-inductive) on 208 volts, 3 phase 400 cps.
Motor: 24 volts D.C. nominal.
Temperature: — 50° C. to + 80° C.
Vibration: To B.S.S. G/10.
Acceleration: To B.S.S. G/100.
Connections:
Fire and Waterproof Plessey Breeze Plugs.
6 pin.
4 pin.
3 pin.

Teddington AUTOMATIC CONTROLS

TEDDINGTON CONTROLS LTD., CEFN COED, MERTHYR TYDFIL, SOUTH WALES. *(Merthyr Tydfil 666).*



For the "Britannia," The Bristol Aeroplane Co. chose 'Layrub' as the transmission system between engines and the "Rotol" accessory gear box. With no metal-to-metal contacts, and no moving parts, the Layrub system gives true *cushioned* and *silent* drive.

Other famous British aircraft in which Layrub is used, either as auxiliary or main drive, include the "Bristol Brabazon," "Saunders-Roe Princess," Bristol Helicopters, etc.

Drop us a line and we will send you full details.

LAYCOCK ENGINEERING LTD.,
VICTORIA WORKS, MILLHOUSES, SHEFFIELD, 8

Layrub serves shock-free without-lubrication

M.C.34

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

GOODBYE: As the last beloved "Lanc" goes out of Bomber Command service this week it is appropriate to publish this photograph, taken in 1942, of two of the very earliest Avro Lancasters to fly on operations. To many wartime pilots it will bring back a flood of memories—pleasant and otherwise. (*See Wyton Occasion.*)

A.V-M. J. P. J. McCauley

C.A.S. designate to the Royal Australian Air Force, A.V-M. J. P. J. McCauley, C.B., C.B.E., R.A.A.F., is at present in Britain visiting the various R.A.F. Commands. Later he will spend several days with the Allied air forces in Europe and will return to Australia about the middle of this month.

A.V-M. McCauley is due to succeed Air Marshal Sir Donald Hardman, K.C.B., O.B.E., D.F.C., R.A.F., in January next.

Wyton Occasion

PRIDE and regret were both expressed in the speeches at R.A.F. Wyton's guest night last Friday: pride in the performance of the R.A.F. Canberra team in the New Zealand race, regret at the passing out of service of the Lancaster, for the object that evening was to mark both these events.

Among the guests were Bomber Command's C-in-C. (Air Marshal G. H. Mills, C.B., D.F.C.), and S.A.S.O. (A.V-M. A. McKee, C.B., C.B.E., D.S.O., D.F.C., A.F.C.), A.O.C. No. 3 Group (A.V-M. E. C. Hudleston, C.B., C.B.E.), the Air Race Flight, and S/L. L. M. "Dick" Whittington, A.F.C., now representing the English Electric Company. Proposing the health of the guests, the C.O., G/C. L. J. Stickley, O.B.E., D.F.C., said that from the work of the Air Race Flight—"a team in the best sense of the word"—the proficiency of Canberra units had been advanced at least six months.

Replying, Air Marshal Mills commented that the race flight had made the whole thing look very easy. Their success, he emphasized, was due to a truly combined effort. Referring amid loud and prolonged cheers to the Lancaster, the C-in-C. recalled that Bomber Command could not have achieved its wartime success without this machine. With it, air power, as visualized by Lord Trenchard and others, had actually been produced. The Lancaster was indeed a worthy predecessor to the V-bombers.

W/C. L. M. Hodges, D.S.O., D.F.C., leader of the flight and pilot of the P.R.7 Canberra, spoke next. Modestly beginning "Everyone's heard quite enough about the air race," he went on to give an entertaining account of the crews' subsequent activities in New Zealand and during the return journey. After thanking all who had helped towards the Canberra's success, W/C. Hodges presented leather-bound copies of the race programme to the station commander, A.O.C. No. 3 Group and the C-in-C. on behalf of Mr. Hume Christie, president of the air-race council.

In response to popular and deafening demand, brief speeches were then made by the pilot of the winning Canberra, F/L. R. L. E. Burton, A.F.C., and (reluctantly) by his navigator, F/L. D. H. Gannon, D.F.C., who suggested simply that everyone should stop talking and get on with the serious business of the evening. The assembly then adjourned to do just that, leaving as sole occupants of the dining hall the mute, real stars of the evening, a model of a Lancaster and a model of a Canberra.

Bomber Command's last Lancaster machine, PA 427, belonged to 82 Squadron, which completed in 1952 a six-year photographic survey of Colonial territories in Africa, covering 1,216,000 square miles. This particular aircraft joined the squadron in May last year, after being engaged on operational training and, later, photographic reconnaissance work, and has flown a total of 1,043 hours.

As is well known, the Lancaster was developed from the twin-engined Manchester. It flew its first operation on the night of March 3rd, 1942. Altogether, 7,366 Lancasters were built, and at the peak of its strength Bomber Command possessed 42 squadrons of them. More than 156,000 wartime sorties were flown, and 608,612 tons of bombs dropped, by Lancasters.

Laurence Minot Trophy

TODAY, at R.A.F. Station Marham, Norfolk, Marshal of the R.A.F. Lord Tedder is due to present the Laurence Minot Bombing Trophy to No. 115 Squadron, on whose behalf it will be received by the commanding officer, S/L. L. G. Holmes, D.F.C., A.F.C. Second this year was No. 7 Squadron.

Lord Tedder is also presenting the Bomber Command Aircraft Servicing Efficiency Trophies to the C.T.O. Marham, W/C. H. F. Cook, O.B.E. This is the second year in succession that Marham, commanded by G/C. O. R. Donaldson, C.B.E., D.S.O., D.F.C., has won the Efficiency Trophies, which were given by Rolls-Royce Ltd., and A. V. Roe and Co., Ltd.

O.U.A.S. Dinner

ON November 27th Oxford University Air Squadron gathered in the Headquarters in Manor Road, Oxford, for the Squadron's annual dinner. The full membership of 100 pilots and the still-young 20-man F.C.U. sat down to an excellent dinner in company with a number of distinguished guests from the Service and the University. Representatives from the U.S.A.F. bases at Brize Norton and Upper Heyford were also present.

The occasion showed once again the strong link that exists in such squadrons between university and Service—a link which the R.A.F. regards as most important and which the universities themselves have come to approve. Sir Maurice Bowra, Vice-Chancellor of the University, proposing the toast of the Air Squadron, pointed out in his speech that not only did the Service gain a useful foothold in the seats of learning, but that the squadron also provided a most useful distraction from the serious curricular activities, for those whose enthusiasms demanded practical and stimulating expression. This link—of which the Chief of the Air Staff, Air Chief Marshal Sir William Dickson, also spoke in replying for the guests—had been strengthened by the personality and leadership of the Commanding Officer, W/C. F. A. Willan, D.F.C.

W/C. Willan is now relinquishing his command, to the regret of all the members, and is taking up an appointment in Coastal Command Headquarters. His successor, W/C. G. H. Nelson-Edwards, D.F.C., was present at the dinner, and will take over command on December 7th.

In the course of the after-dinner speeches, allusion was made to certain "exchange visits" which had taken place during the squadron's annual camp, when the squadrons from Bristol, Southampton and St. Andrew's universities were also in camp close by. The Commanding Officer then referred to the initiative of the Squadron's pilots, especially when flying solo, which, he said, tended mainly in a downward direction and was matched only by the vigilance of the instructors.

The C.A.S. told of his recent experience

SERVICE AVIATION . . .

of flying in a B-47, an aircraft which he learnt had been seen low over the squadron's airfield at Kidlington on many occasions.

No. 4 Squadron Standard

ADDRESSING the parade after presenting No. 4 Squadron with its Queen's Standard at Jever, Germany, on November 20th, Marshal of the Royal Air Force Sir John Slessor dwelt on the unit's long history. "You really have something to be especially proud of in No. 4 Squadron," he said. "It was an aircraft of your squadron, together with another of No. 3 Squadron, which did the first reconnaissance of the Great War on August 19th, 1914. No. 4 Squadron got the first enemy aircraft ever to be brought down; and here are you as a ground-attack squadron now, and you can say that your squadron carried out the first low-flying attack on an enemy column ever made—nearly forty years ago, on the 31st of October, 1914."

Sir John continued: "The squadron fought in France all through the first Great War right up to the bitter end, and after the war it had hardly got home when it was sent off to Gallipoli—where you put up another record by being the first squadron ever to fly an ordinary landplane off the deck of a carrier.

"I took over command, when the squadron got back from Gallipoli, from a S/L. Blount, who later commanded an air component in France in 1940, and whose son is a wing commander flying in 2nd T.A.F. today.

"Then, nearly twenty-five years to a day after you first went to France, you found yourselves in France again and in the second Great World War. When the Germans invaded Belgium you were the first unit to move up into Belgium. You fought through those terrible three weeks and then came away from Dunkirk. And four years later, you were back again in the front line over the Normandy beaches and fought with the Army right up through France into Germany and here you are today."

Sir John ended by saying: "I hope you will be here for a long time, because what you are doing now is to make sure that you will never have to do again what you have spent about ten years of your forty years of existence doing—namely, fighting in the great wars."

Jet Accidents

A QUESTION was recently asked in the House of Commons about the number of fatal accidents involving jet aircraft, particularly during close formation flying. The Under-Secretary of State for Air, Mr. Ward, stated in a written reply that during the twelve months ended October 31st, 1953, there had been 135 fatal accidents involving R.A.F. jet aircraft. Of these, 15 were due to collision and seven of these collisions occurred during close formation flying. Mr. Ward said that such flying was still a tactical necessity for day-fighter ground-attack aircraft, and that the accident figures showed that the inherent hazards had been minimized by careful training.

ALMOST A HELICOPTER: A Prestwick Pioneer (Alvis Leonides engine) now in service, about to take-off from an air strip in Malaya. The R.A.F. stipulate 80 yd as sufficient take-off or landing run and 180 yd to clear a 50ft obstacle. The Pioneer is a four-seater plus pilot.

To Command No. 22 Group

IT is announced by the Air Ministry that A. Cdre. J. L. F. Fuller-Good, C.V.O., C.B.E., is to be A.O.C. No. 22 Group, Technical Training Command. He will assume the acting rank of air vice-marshal.

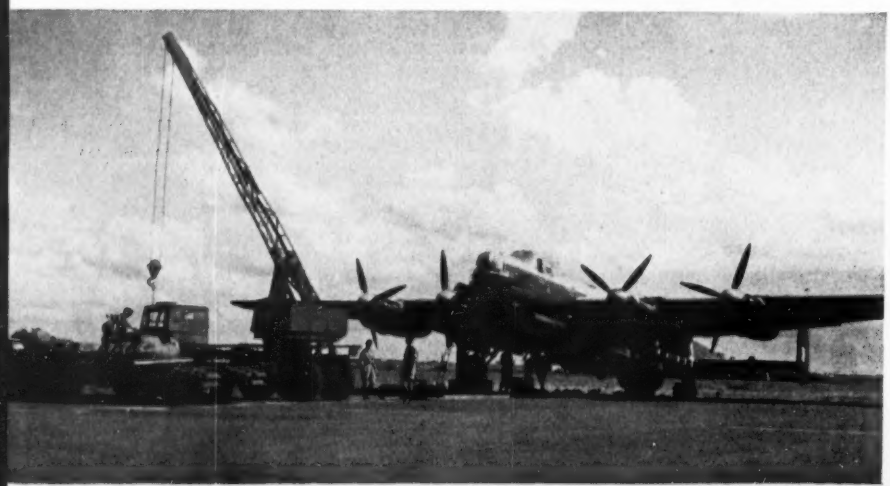
Since May last year, A. Cdre. Fuller-Good has been Director of Personal Services (A) and before that commanded R.A.F. Station Changi at Singapore.

1,000th Flying Scholarship

ON Thursday of last week, Lord Brabazon of Tara, who holds Pilot's Certificate No. 1, presented the 1,000th "A" licence to be won under the A.T.C. flying scholarship scheme. The recipient was H. E. B. Mayes of No. 2226 (Cirencester Grammar School) Squadron.

The scheme, devised by the Air League in 1949 and since sponsored by the Air Ministry, has been responsible for the training to "A" licence standard 1,019 members of the A.T.C. and R.A.F. sections of the C.C.F. Another 106 are now under training.

IN KENYA: A Lincoln of No. 49 Squadron, now being used against the Mau Mau, is re-armed at Eastleigh Airport, Nairobi. 1,000 lb. and 500 lb. bombs are being used.



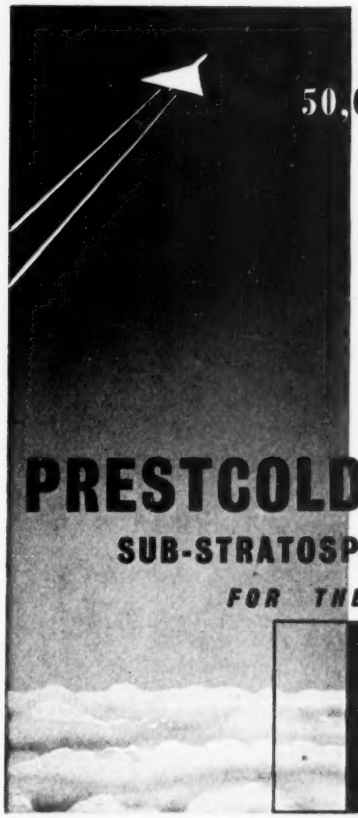
A.T.C. Efficiency Trophy

IT was recently stated that No. 1143 (Portobello) Squadron were the winners of the A.T.C. Efficiency Trophy. It is now learned that the actual winners were No. 384 (Mansfield) Squadron with No. 261 (Guildford) and No. 204 (City of Lincoln) Squadrons second and third respectively.

R.A.F. Appointments

THE Air Ministry announces the following recent appointments. *Group Captains:* V. H. B. Roth, C.B.E., to command No. 61 M.U.; B. A. J. Crummy, C.B.E., to No. 61 Group air staff; R. F. Aitken, O.B.E., A.F.C., to command Horsham St. Faith; J. C. Larking, D.F.C., to command Tarrant Rushton; C. R. J. Hawkins, O.B.E., A.F.C., to command Oakington; A. Selby, to command No. 14 M.U.; K. T. Nicklin, O.B.E., to department of Air Member for Supply and Organization. Acting Group Captain F. A. Willan, D.F.C., to Coastal Command administrative staff.

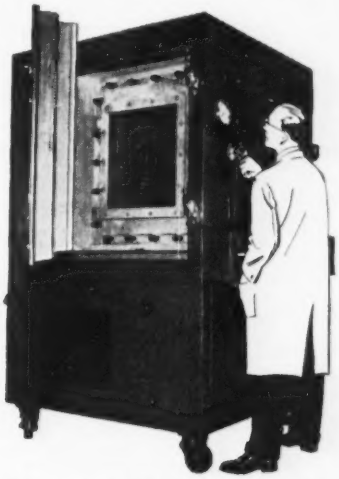
Wing Commanders: G. Burges, O.B.E., D.F.C., to Seletar for flying duties; D. O. F. Lumsden, D.F.C., to No. 22 Group air staff; T. Preston, D.F.C., and T. A. Whiting, D.F.C., to department of Chief of the Air Staff; H. E. Bodien, D.F.C., to West Malling administrative staff; R. D. Romanis to No. 12 School of Technical Training; H. W. Ford to H.Q. F.E.A.F. administrative staff; A. F. Merritt to department of Air Member Personnel; C. T. W. Morgan to Hednesford administrative staff; C. V. Guest, O.B.E., to Technical Training Command technical staff; S. H. Bonser, M.B.E., to department of Chief of the Air Staff; E. T. Weddell, M.C., to Bridgnorth administrative staff; A. Prescott, to West Kirby administrative staff; T. E. J. Hewitt, to Hednesford administrative staff; G. G. Edwards, to No. 11 Group administrative staff; R. N. H. Courtney, D.F.C., to No. 11 Group air staff; F. V. Morello to H.Q. Northern Sector air staff; W. G. Clegg, O.B.E., to command No. 202 M.U.; J. B. Taylor, O.B.E., to Maintenance Command administrative staff.



50,000 FEET UP, –65°C DOWN . . .

with both feet on the ground

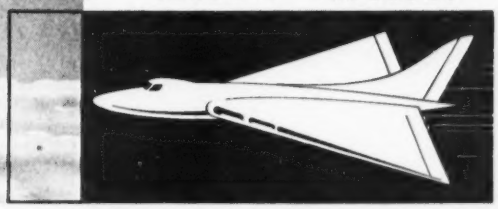
This unique Prestcold cabinet — designed specifically for the aircraft and allied industries—provides a temperature range from +60°C down to —65°C, and a range of pressures corresponding to 1,000′ below sea level to 50,000′ altitude, for the accurate testing in the laboratory of airborne apparatus and components. A leaflet giving full technical details and specification is available on request either from Pressed Steel Company Limited at Cowley or from your area Prestcold Distributors.



PRESTCOLD *L.H.V.P. 65/8*

SUB-STRATOSPHERE TEST CABINET

FOR THE AIRCRAFT INDUSTRY



PRESSED STEEL COMPANY LIMITED, REFRIGERATION DIVISION, COWLEY, OXFORD *Manufacturers of Commercial, Industrial, Medical and Domestic Refrigeration*

AIRCRAFT
★ OPERATORS
★ DESIGNERS
★ PLANNERS
We have for immediate delivery one of the largest and most comprehensive stocks of aeronautical, electrical and ancillary equipment in the country.
Fully A.R.B. and A.I.D. approved.

P.W.GREENWOOD

(WILLESDEN) LTD · 62 SHIRLAND RD · LONDON W9

BRITISH EMULSIFIERS LIMITED

AND

ASSOCIATED COMPANIES

Specialists in Sheet Metal Fabrication Design and Prototype Production for the Aircraft, Motor and Marine Industries

A.I.D. & A.R.B. APPROVED

Drop Tanks	Wing and Tail Sections
Internal Fuel Tanks	General Aircraft Repair Work
Hydraulic Header Tanks	Oil Dispensing Cabinets
Filter Assemblies	Gas-Heating Cabinets
Beams and Fairings	Cooling Cabinets
Bomb Release Units	Radiator Cores

All enquiries to:

16/24 Brewery Road, London, N.7

Telephone: NORTH 4411/7

FLIGHT and AIRCRAFT ENGINEER

PRESS DAY — *Classified advertisement "copy" should reach Head Office by* FIRST POST THURSDAY *for publication in the following week's issue subject to space being available.*

CLASSIFIED ADVERTISEMENTS

Advertisement Rates. 4/- per line, minimum 8/-, average line contains 6-7 words. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Tenders 5/- per line, minimum 10/-. Each paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

Postal Orders and cheques sent in payment for advertisements should be made payable to Iliffe & Sons, Ltd., and crossed & Co.

Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

Box Numbers. For the convenience of private advertisers, Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street, London, S.E.1.

The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

Situations Vacant. The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service etc. if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

15 CHESTERFIELD ST., W.1
Telephone : GROsvenor 4841

AIRWORK LIMITED

AIRCRAFT SALES SINCE 1930

Consult us with confidence before Buying or Selling any type of Aircraft. You pay nothing for our advice and experience. We advertise for sale only aircraft available on our own premises or for which we have the sole selling rights.

AIRCRAFT FOR SALE

AEROPLANES BY DUNDAS!

THIS week we bring to your attention the following aircraft that we have available for immediate sale.
YORKS
DAKOTAS
BRISTOL FREIGHTERS
AVRO XIX's
and
AUSTER V's
THE above aircraft are in exceptional condition and are offered at reasonable prices.
FOR details of these and many others apply:
F.
R.
K.
DUNDAS, Ltd.,
29 BURY STREET, St. James's, London, S.W.1.
CABLES: "Dundasaero, Piccy, London."
CROYDON AIRPORT. Croy. 7744.

AEROPLANES BY DUNDAS! [0559

W. S. SHACKLETON, LTD.

FOR
AUTOCRATS
AIGLET TRAINERS
RAPIDES
TIGER MOTHS
MESSENGERS
PROCTORS
MOTH MINORS
MAGISTERS
WE have the above aircraft actually in stock. New or long-term Certificate of Airworthiness.
ALL these are carefully selected machines of export quality and in quite beautiful order.

W. S. SHACKLETON, LTD.

175, PICCADILLY, LONDON, W.1.
Tel.: Hyde Park 2448/2449.
Overseas Cables: "Shackhud, London." [0070

AEROSERVICES (LONDON) LIMITED

Suppliers of aircraft, engines and accessories. Principals are invited to write or call

AEROSERVICES (LONDON) LIMITED

CROYDON AIRPORT
SURREY.
Tel.: CROydon 8833.
Cables: "Aeropaul, Croydon." [0940

AVIRAD, Ltd.
LOCKHEED Lodestars, PBY5A amphibious Catalinas and Avro XIX aircraft available for immediate delivery. Also spares and equipment for all types of aircraft and engines.
AVIRAD, Ltd., Croydon Airport. Surrey. Tel.: Croydon 7744. Cables: Avirad, Croydon. [0500
VENDAIR OF CROYDON AIRPORT offer:
AUSTERS, Taylorcraft, Proctors, Messengers, Gemini, Magisters, Ansons, Fairchild Argus, Stinson Voyager, Bonanzas.
VENDAIR Croydon Airport. Croydon 5777. [0603
TIGER MOTH, low engine and airframe hours, 12 months' C. of A. £250.—Box 2105. [1376

AIRCRAFT WANTED

LYCOMING-ENGINED Auster required, any condition. Full details to Box 2071. [1366

HELMETS
MASKS
TUBES
RECEIVERS
GOGGLES
SPARES, etc.

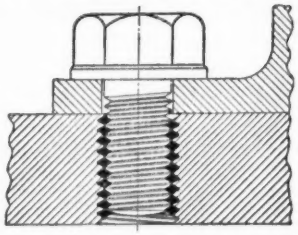
We are the complete stockists for pilots' personal flying equipment of civilian and service pattern.

Send 3d. for Illustrated Catalogue

Special terms to Flying Clubs

D. LEWIS LTD. (DEPT F.)
124 GT. PORTLAND ST., LONDON, W.1
Tel. Museum 4314 *Grams : Aviakit, Wesdo, London*

WIRE
THREAD INSERTS



FOR NEW DESIGNS AND SALVAGE
CROSS MFG. CO. (1938) LTD.
COMBE DOWN, BATH
Tel.: COMBE DOWN 2355/6

The . . .
British Air Line Pilots' Association
95 MOUNT STREET, W.1
Tel.: GROsvenor 6261

Membership open to all Commercial and Service pilots. For full details as to the objects and particulars of Membership please write to the Secretary.

AIRCRAFT WANTED

OUR demand for good used aircraft of all descriptions is very great. Operators or owners wishing to dispose of aircraft, engines, or anything aeronautical, are asked to communicate at once to:—
R. K. DUNDAS, Ltd., 29 Bury Street, London, S.W.1.
WHI. 2848. Cables: "Dundasaero, Piccy, London."

CROYDON AIRPORT. CRO. 7744. [0558

AEROCONTACTS, Ltd., have a requirement for a limited number of sound Cirrus Major Messengers, Geminis, Autocrats, and Gipsy-powered Austers.—Aerocontacts, Ltd., Gatwick Airport, Horley, Surrey. Tel.: Horley 1510. [1313

AIRCRAFT ACCESSORIES AND ENGINES

A. J. WALTER.

NOTICE to Dakota operators:—

OUR vast stock of airframe spares, instruments, accessories, etc., is available to assist you to keep flying with the minimum of time spent on the ground due to service troubles. Whatever your requirements, do not hesitate to contact us, by letter, telephone or cable, or alternatively by a personal visit, when we shall be pleased to show you the stocks held at Gatwick Airport.

OUR Associate Company, A. J. W. (Instruments), Limited, can undertake any instrument overhaul work and we also provide facilities for an exchange scheme on instruments at overhaul prices.

A. J. WALTER, Gatwick Airport, Horley, Surrey. Tel.: Horley 1420 and 1510, Ext. 105. Cables: Cubeng, London. [0268

BRITISH and American filaments; landing lamps; fuses, generators, gyros, cabin heaters, spares.—Suplex Lamps, Ltd., 239 High Holborn, London W.C.1. Tel.: Hol. 0225 and 4543. [0433

AIRCRAFT SERVICING

BROOKLANDS AVIATION, Ltd., Brooklands Aerodrome, Weybridge. C. of A. overhauls, modifications and conversions. Tel.: Byfleet 436. [0305

REPAIRS and C. of A. overhaul for all types of aircraft.—Brooklands Aviation, Ltd., Civil Repair Service, Sywell Aerodrome, Northampton. Tel.: Moulton 3218. [0307

AIRCRAFT FOR HIRE

PIPER Cub—hire and fly yourself. Moderate rates, hour, day, week or month.—A. J. Walter, Gatwick Airport, Horley, Surrey. Tel.: Horley 1420 and 1510. [0269

BUSINESS OPPORTUNITIES

WYNSTRUMENTS, Ltd., of Staverton Aerodrome, Gloucester, are open to consider the development and/or manufacture of inventions relating to aircraft instruments or small electrical accessories. Particulars should be addressed to the Managing Director. [1252

CAPACITY AVAILABLE

PRECISION engineers. Personal service for prototypes, small quantity machined parts and equipments to drawings and sketches. A.I.D. approved, Mech. and Elec.—Cathanode, Ltd., Vineyard Walk, Clerkenwell, E.C.1. Tel.: TERminus 2231. [1280

CLOTHING

R.A.F. and R.N. officers' uniforms purchased; large selection of R.A.F. officers' kits for sale, new and reconditioned.—Fisher's Service Outfitters, 85-88 Wellington St., Woolwich. Tel.: Woolwich 1055 [0567

CLUBS

VENDAIR FLYING CLUB. Night flying and instrument flying. Croydon Airport. CRO. 5777. [0608

REDHILL FLYING CLUB, Redhill Aerodrome, Surrey for flying instruction. Open 7 days a week, Nutfield Ridge 2245. [0348

LONDONERS! Your most accessible and reasonable club. M.C.A. approved courses. Austers 45/- hour, trial lesson 17/6. Phone Penguin Flying Club, Vic. 1300. [0285

HERTS and ESSEX AERO CLUB, Broxbourne Aerodrome, Nazeing, Essex. M.C.A. approved 30-hour course; residential; trial lessons, 35/-; train from Liverpool Street or Green Line Coach 715. Tel.: Hoddesdon 2453, 2421. [0230

FIELD'S

A Hunting Group Company

OFFER A QUANTITY OF

TR. 1464 AND TR. 5025

FOUR CHANNEL

VHF RADIOS

removed from

VIKING AIRCRAFT

due to re-equipment

SUITABLE FOR

LIGHT AIRCRAFT

available

EX-STOCK

at £60 each

Full Details from

FIELD AIRCRAFT SERVICES LIMITED

CROYDON AIRPORT · CROYDON SURREY

Phone: CROydon 7777

Cables: FIELDAIR, CROydon

129/152

CONSULTANTS

GROUP CAPT. E. L. MOLE, B.Sc., A.F.R.Ae.S., 31 Dover St., London W.1. Gro. 5902. [0400

WING COMMANDER R. H. STOCKEN, F.R.Ae.S., Eagle House, 109 Jermyn St., London S.W.1. Tel.: Whitehall 8863. [0419

R. K. DUNDAS, Ltd., have been giving the correct answer to aviation problems for twenty years. Technical. Purchasing. Operations. Marketing. 29 Bury Street, London S.W.1. WHI. 2848. [0560

MISCELLANEOUS

ONE only, steel-framed building, 81ft clear span by 200ft to 250ft long by 25ft to eaves (22ft clear height inside), steel sheeting, sliding doors at ends, material from stock.—Write Bellman Hangars, Ltd., Terminal House, S.W.1. [1331

PACKING AND SHIPPING

R. AND J. PARK, Ltd., 143-9 Fenchurch St., E.C. Tel.: Mansion House 3083. Official packers and shippers to the aircraft industry. [0012

EXPORT PACKING SERVICE, Ltd., Imperial Buildings, 56 Kingsway, W.C.2. Phone: Chancery 5121-2-3. Scientific packers to the Services and industry. Specialists in the packing of aircraft and aircraft components. Approved packers for the Admiralty, A.I.D., I.F.V., C.I.A., C.I.S., I.E.M.S., M.o.S. and many foreign Government Departments. [0920

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned application to operate a scheduled air service:—

Application No. 226 from Air Kruise (Kent), Ltd., of Lympne Airport, near Hythe, Kent, for a seasonal normal scheduled service, initially with DH89A aircraft and later possibly with DH Dove, DH Heron or Dakota aircraft, for the carriage of passengers and/or supplementary freight between Lympne and Calais at a frequency of from three to five services daily during the season from April to September inclusive, for a period of seven years commencing April 1st, 1954.

THIS application will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to this application must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections. [1374

TUITION

AVIGATION, LTD.

(The Safe Guidance and Handling of Aircraft in the Air)

30 CENTRAL CHAMBERS, EALING, W.5.

WE offer all courses appertaining to pilot/navigator licences.

DO contact us on any problem you have in mind and we will do our utmost to help. [0248

TWIN CONVERSIONS

GEMINI aircraft, fitted radio, £6 per hour day, £7 per hour night; dual or solo.—Southend Flying School, Essex. Rochford 56204. [0333

THE LONDON SCHOOL OF AIR NAVIGATION.

ALL features pilot/navigator qualifications: 60 per cent. of total passes in Senior's. Those sponsored 95 per cent. pass at first sitting in Junior's. Our personal coaching methods unsurpassed. New "Home Study" courses excellent alternative; finest of kind; full coverage; unique in application; ideal those seeking career or higher licences. Link; briefing, procedures and R/T; type ratings; refresher with instrument flying, basic and advanced. Integrated scheme most efficient and economical. Advice without obligation.
33 Ovington Square, Knightsbridge, London, S.W.3. Ken. 8221. [0277

LEARN to fly for £24; instructors' licences and instrument flying for £3 per hour; night flying £4 per hour; residence 5 gns. weekly. Approved M.C.A. private pilot's licence course.—Wiltshire School of Flying, Ltd., Thruxton Aerodrome, Andover, Hants. [0253

EAGLE

SERVICE MAINTAINS YOUR HIGH STANDARDS

- Aircraft Servicing.
- Overhaul and Modification Service.
- Spares—Large Stocks.
- Equipment and Component Parts.
- Purchase and Sale of Aircraft.

A.R.B. & A.I.D. APPROVED

E.A.S.L

EAGLE AIRCRAFT SERVICES LIMITED

A COMPANY OF THE EAGLE GROUP

Blackbushe Airport, Camberley, Surrey

Telephone: Yateley 2371 (p.b.x.)

London Office: 29, Clarges Street, London, W.1

Telephone GRO 6411

TUITION

NIGHT flying. Auster and Gemini aircraft with radio, from £4 per hour.—Southend-on-Sea Flying School. Tel.: Rochford 56204. [0451

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "no pass no fee" terms; over 95 per cent. successes. For details of exams and courses in all branches of aeronautical work, navigation, mechanical eng., write for 144-page handbook, free.—B.I.E.T. (Dept. 702), 17 Stratford Place, London, W.1. [0707

FREE! Brochure giving details of courses in all branches aero eng. covering A.F.R.Ae.S., A.R.B. Certs., M.C.A. exams, etc. We are the only postal training college operated by an industrial organization. —Write to E.M.I. Institutes Postal Division, Dept. F.26, 43 Grove Park Rd., London W.4. (Associated with H.M.V.) [0962

AERONAUTICAL. Comprehensive full-time technical and practical training for careers in all branches of aviation engineering. Diploma course leads to interesting executive appointments in civil aviation, design and development, draughtsmanship, maintenance, etc. Extended courses to prepare for A.F.R.Ae.S. and A.M.I.Mech.E. examinations.—Write for prospectus to Senior Master, College of Aeronautical Engineering, Chelsea, London S.W.3. Flaxman 0021. [0019

SOUTHEND - ON - SEA MUNICIPAL AIR CENTRE AND FLYING SCHOOL, Essex. Tel.: Rochford 56204. Training for private, commercial licences and instructor's endorsements. M.C.A. approved 30-hour course. Tiger Moth and Auster aircraft. Special facilities for training in instrument ratings and radio procedure. Hourly dav rates: Solo £3, dual £3/5/-. Contract rate £2/10/-. Night: £4 solo, £4/5/- dual. No entrance fee or subscription. Trial lesson 30/-. [0332

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

THE ENGLISH ELECTRIC CO., LTD., LUTON

have vacancies for the following technical staff on an interesting high-priority defence project.

(1) Senior Radar Engineers

APPLICANTS should have a sound theoretical background and have had considerable experience in the operation, maintenance and modification of experimental radar systems in the field. Ref. 1190A.

(2) Electronic Trials Engineers

APPLICANTS should have experience of high-frequency communication equipment and be prepared to accept responsibility for its installation and subsequent trial at locations in the U.K. other than Luton. Ref. 456P.

(3) Electronic Trials Assistants

SUCCESSFUL applicants will become members of trials teams under the leadership of electronic trials engineers and will be required to assist in the installation and subsequent trial of H.F. communication equipment. Ref. 456R.

(4) Electronic Laboratory Assistants

APPLICANTS should have experience of the preparation (from circuit diagrams) of information for the drawing office and production departments. Ref. 1066D.

(5) Radar Assistants

APPLICANTS will be required to assist senior radar engineers in the operation, maintenance and modification of experimental radar systems in the field. Ref. 1190B.

(6) Electronic Laboratory Assistants (Trials)

APPLICANTS should have experience of the preparation of radar equipment for field trials, for which a sound basic knowledge of radar circuitry is essential, and special knowledge of radar equipment A.A. No. 3 Mk. 7 would be an advantage. Ref. 1066E.

SALARIES are appropriate to the qualifications and experience necessary for the various positions, which are permanent and progressive. A staff pension scheme operates and housing assistance will be provided for suitable applicants for posts (1), (2), (3) and (6). Applications to Dept. C.P.S., 336/7 Strand, W.C.2, and quoting appropriate reference number. [1341

STRESSMEN and design draughtsmen urgently required for new project work. Highest grade salaries and pension scheme to suitable applicants. Reply, giving details of age, experience and qualifications to Personnel Manager, Scottish Aviation, Ltd., Prestwick Airport, Ayrshire. [1287

SPERRY GYROSCOPE CO., LTD.

invite applications from Engineers holding a degree or membership of a professional Institute, for interesting development work on aircraft instrumentation, automatic controls, marine products and guided missiles. Vacancies include:—

ELECTRONIC ENGINEERS for Brentford, Feltham and Gloucestershire. Additional to above qualifications, practical experience and knowledge of production methods with experience of one or more of the following is desirable. Control circuits, D.C. Amplifiers, Computing devices, Video circuits, Microwave techniques.

HYDRAULIC ENGINEERS for Brentford. Essential to have apprenticeship and knowledge of production methods.

MECHANICAL AND ELECTRO-MECHANICAL ENGINEERS for Brentford, Feltham and Gloucestershire. Additional to above qualifications, desirable to have apprenticeship, knowledge of production methods and experience in design of one or more of the following: gearing, instrument mechanisms, servos.

PENSION SCHEME

Apply, giving full details, including an indication of the salary range and location preferred, to:—

Personnel Manager,
Sperry Gyroscope Co., Ltd.
Great West Road,
Brentford, Middx.

AIRWORK LIMITED

RADIO SECTION

have IN STOCK for immediate delivery, brand new EKCO CE1140 lightweight VHF Installations, Murphy MR60/80 Installations, also Standard STR9X equipments, available at very short notice. A large quantity of equipments such as American TA2J complete and SCR522, IN STOCK.

All Enquiries

RADIO SUPERVISOR
TERMINAL BUILDINGS
GATWICK AIRPORT, HORLEY
SURREY

HORLEY 1510 1551

SITUATIONS VACANT

VICKERS-ARMSTRONGS, LIMITED WEYBRIDGE

Guided Weapons Development

A VACANCY exists for a senior project engineer to control a group on missile development. Experience in electronics and graduate or equivalent qualifications required.

APPLICATIONS, with the names of two referees, should be made, quoting reference EO/G.W.2, to the Employment Manager, Vickers-Armstrongs, Ltd., Weybridge Works, Weybridge, Surrey. [1371

AMENDED ADVERTISEMENT

SENIOR scientific officers, scientific officers, patent examiner and patent officer classes. The Civil Service Commissioners invite applications for permanent and pensionable appointments to be filled by frequent competitive interviews. The scientific posts are in various Government departments and cover a wide range of scientific research and development in most of the major fields of fundamental and applied science. In biological subjects the number of vacancies is small: individual vacancies exist at present for candidates who have specialized in palaeobotany, invertebrate fossils and foraminifera. The Patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

CANDIDATES must have obtained a University degree with first or second class honours in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification; or for scientific posts, possess high professional attainments. Candidates for senior scientific officer posts must in addition have had at least three years' post-graduate or other approved experience.

AGE limits: Senior scientific officer, between 26 and 31, but specially suitable candidates under 26 may be admitted. For scientific officers and patent classes, between 21 and 28 during 1953 (up to 31 for permanent members of the experimental officer class competing as scientific officers). Inclusive London salary scales: Senior scientific officers—men, £917 to £1,075; women, £786 to £949; scientific officers—men, £440 to £812; women, £440 to £707. Patent examiner and patent officer classes—men, £440 to £760; women £440 to £576. Women's rates for patent classes under review. Somewhat lower rates in the provinces.

FURTHER particulars from the Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London W.1, quoting No. S.53/53 for senior scientific officers and S.52/53, S.128/53, for the other posts. Completed application forms to be returned on or before December 31st, 1953. [1365

VICKERS-ARMSTRONGS, LIMITED WEYBRIDGE

Guided Weapons Development

A VACANCY exists for an experienced engineer to take charge of a group engaged on the development of missile control systems and associated simulators.

APPLICATIONS, with the names of two referees, should be made, quoting reference EO/G.W.1, to the Employment Manager, Vickers-Armstrongs, Ltd., Weybridge Works, Weybridge, Surrey. [1372

D. NAPIER AND SON, LTD.

have varied and interesting vacancies in their AERO GAS TURBINE DIVISION in London and in their Research Station at Liverpool. Applications are invited from:

DESIGNER DRAUGHTSMEN AND TECHNICIANS

of senior, intermediate and junior grades for design, development and mechanical research. The positions are permanent and pensionable. Interview travelling expenses will be paid. Please write, with all details, quoting ref. S.A.30C to Dept. C.P.S., 336-7 Strand, London, W.C.2. [1337

HUNTING AIR TRANSPORT LTD.

require Dakota and Viking captains with A.L.T.P. Licence, Group 1 endorsement. Established appointments, pension scheme, etc.

Write: Flight Captain, Hunting Air Transport, Ltd., Bovingdon Airport, Hemel Hempstead, Herts. [1379

VICKERS-ARMSTRONGS, LIMITED WEYBRIDGE

Guided Weapons Development

A SENIOR trials engineer is required for work on weapon development. Experience of running field trials and graduate or H.N.C. qualifications required.

APPLICATIONS, with the names of two referees, should be made, quoting reference EO/G.W.3, to the Employment Manager, Vickers-Armstrongs, Ltd., Weybridge Works, Weybridge, Surrey. [1370

BLACKBURN & GENERAL AIRCRAFT LIMITED

have vacancies at BROUGH (E. Yorks) in the following categories:—

DRAUGHTSMEN

Senior and intermediate grades. Previous aircraft experience essential for senior grade and desirable for intermediate grade.

STRESSMEN

Senior and intermediate grades of H.N.C. minimum standard. Previous aircraft experience essential for senior grade and desirable for intermediate grade.

STRUCTURAL & MECHANICAL TEST SECTION

Technical Assistants with experience of test work on aircraft structures and installations, test result analyses, and compilation of reports.

FLIGHT TEST DEVELOPMENT SECTION

Senior Technical Assistants for planning of Handling & Performance flight test programmes, flight test observing, analysis of test results and compilation of reports. Good aerodynamics and technical background and previous experience of this type of work essential.

Senior Flight Test Engineers for similar work on Installations. Good engineering and technical background and previous experience essential.

The Company's programme on Military and Civil aircraft offers excellent prospects of permanent and interesting work, under congenial conditions at salaries commensurate with qualifications, ability and experience.

Applications, giving particulars of age, training and experience to:—

THE PERSONNEL MANAGER
Blackburn and General Aircraft Ltd.,
BROUGH, EAST YORKS

H. M. HOBSON LIMITED

have

VACANCIES

in their

DESIGN OFFICE

as under:—

2 SENIOR DESIGNERS

Preferably with experience of hydraulic mechanisms or fuel metering systems.

1 ASSISTANT WEIGHTS ENGINEER

2 STRESSMEN

1 MODIFICATION DRAUGHTSMAN

DESIGN DRAUGHTSMEN

DETAIL DRAUGHTSMEN

The work is of a progressive nature, connected with fuel systems for gas turbines, ram jets, and rocket motors, as well as hydraulic flying control equipment for aircraft and guided missiles.

Good salaries offered.

Out-of-pocket expenses paid to applicants attending interviews.

Apply, stating experience, age and salary required to:—

H. M. HOBSON LTD.
Hobson Works, Fordhouses,
Wolverhampton, Staffs.

SITUATIONS VACANT

INTEGRAL, Ltd., Birmingham Road, Wolverhampton, require designer with experience of hydraulics. APPLY, in writing, stating age, experience and salary required. [1335

VICKERS-ARMSTRONGS, Ltd., now in production of super-priority aircraft, require:—
Draughtsmen (senior and junior), preferably with aircraft experience. Men with mechanical, structural and electrical experience also considered.

PENSION scheme. Recommendation for housing after probationary period.—Write, giving full particulars, including age and salary required, to Personnel Department, South Marston Works, Swindon, Wilts. [1342

A. V. ROE and Co., Ltd., have vacancies in their engineering research department as follows:—

TECHNICIANS are required who have some metallurgical training and are experienced with either steels, aluminium alloys or magnesium alloys. Preference will be given to those possessing the Higher National Certificate or equivalent qualifications in metallurgy or mechanical engineering.

APPLY, stating age, qualifications, experience, also salary required, to the Labour Manager, A. V. Roe and Co., Ltd., Greengate, Middleton, Manchester. [1334

SKYWAYS, Ltd., have vacancies for captains with Civil Licences and Group 1 endorsements on York aircraft. Please communicate with the Personnel Manager, 7 Berkeley Street, W.1. [1290

AIR transport charter require engineer in charge/inspector for their radio workshops. Fully conversant airborne equipments, particularly post-war.—Write in confidence or phone 7 Willow Road, Colnbrook, Slough, Bucks. Tel.: Colnbrook 280. [1355

AIR transport charter require radio engineers and mechanics, conversant airborne equipments (workshop overhaul and repair). £9 per week plus, depending on experience.—Write or phone 7 Willow Road, Colnbrook, Slough, Bucks. Tel.: Colnbrook 280. [1356

SENIOR and intermediate design draughtsmen with good experience of aircraft or light structural or mechanical engineering, required for aircraft and armament project work.—Apply, by letter, to Portsmouth Aviation, Ltd., The Airport, Portsmouth. [0612

LICENSED radio engineer and radio mechanics at our base at Stansted Airport, Essex.—Apply by letter or telephone to the Senior Radio Engineer, Aviation Traders, Ltd., Southend Airport, Essex. Tel.: Rochford 56491. [0950

THE G.E.C. STANMORE LABORATORIES invite applications for the following vacancies for work on guided missile research. Good canteen facilities, sick fund and pension scheme. Holidays above average.

(i) Senior graduate with 1st or 2nd class honours degree or equivalent qualifications required to work on the planning and assessment of complex trials on airborne radar. Previous experience in radar work highly desirable. (Ref. F/LMKB.1).

(ii) Graduate, aged about 30, with good degree or equivalent qualifications required for responsible work on technical flight trials of airborne radar. Previous experience of similar work and of flying is very desirable. There is also a junior post vacant for a man with similar qualifications. Both these posts, together with (i) above, involve some travelling within the United Kingdom. (Ref. F/LMKB.2).

APPLICATIONS should be made in writing to the Staff Manager, G.E.C. Stanmore Laboratories, The Grove, Stanmore Common, Stanmore, Middlesex, stating age, qualifications and experience, and quoting the appropriate reference. [1368

SENIOR position in servo-analysis group working on guided weapon control systems. Applicants should hold honours mathematics degree, have some experience in servo-mechanism systems or electrical engineering. Age 28 to 32 approximately. (Ref. A.)

ELECTRONIC engineer with desire to produce instructional literature on new product. Engineering background, diplomatic approach and command of words more important than knowledge of printing. Will ultimately function as technical editor in charge of section of publications department. (Ref. B.)

PLEASE write in detail, quoting reference of post sought, to Personnel Manager, de Havilland Propellers, Ltd., Hatfield, Herts. [1343

A SENIOR design engineer is required in Canada, to supervise a programme of design, development and manufacture of after-burner units for aviation gas turbine engines. He should be capable of developing specialized laboratory testing facilities and equipment and to be generally responsible for the whole development project.

APPLICANT must have equivalent of a thorough technical college training or graduation from recognized university; ability to work harmoniously with associates on different problems, and ease and skill in directing and training juniors is essential. Shop experience on the construction and repair of high-speed machinery, especially gas turbine machinery, is desired. Experience in testing of gas turbines would be advantageous. This position requires a man of high calibre and salary will be commensurate with experience.—Apply, by letter, to Box 1916, giving full details of your education and experience, salary desired, and references where available. [1326

AIRCRAFT or mechanical draughtsmen, all graded, and junior aircraft stress and weightsmen required, —Apply, stating age, experience and salary required. to the Chief Draughtsman, Alan Muntz and Co., Ltd., Aircraft Division, Langley Aerodrome, Slough, Bucks. [0368

SITUATIONS VACANT

DRAUGHTSMAN required for aircraft fuel gauge installation diagrams and details. Aircraft electrical installation experience preferred but not essential. Canteen; pension scheme.—Apply: Chief Development Engineer, Waymouth Gauges and Instruments, Ltd., Station Road, Godalming, Surrey. [1373

PILOT required for maintenance testing duties in Northern Ireland. Applicants should preferably have recent experience of this work in one of the Services and must be conversant with most modern operational aircraft types.—Write, giving full details of experience and hours flown by types, to Box 2104. [1375

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0420

REQUIRED immediately by Percival Aircraft, Ltd., Luton Airport, Beds, several draughtsmen with comprehensive experience of engine installation and allied systems. Good welfare facilities, including staff pension scheme.—Applications in writing, stating age, qualifications, experience and salary required to the Personnel Manager. [0601

TEST laboratory assistants (male) required by Percival Aircraft, Ltd., Luton Airport, Beds. National Certificate standard and previous experience on design of test laboratory equipment desirable. Good welfare facilities including staff pension scheme.—Applications, stating qualifications, experience, age and salary required to Personnel Manager. [0596

NORMALAIR, Ltd., invite applications from draughtsmen for work on aircraft pressurization and high altitude breathing equipment in their Yeovil and Cricklewood drawing offices. Applicants should be of H.N.C. standard. A generous superannuation scheme is in operation. Applications should be addressed to the Personnel Officer, Normalair Ltd., Yeovil. [1288

MINISTRY of Education: Assistant Keepers, Science Museum. The Civil Service Commissioners invite applications for two posts of assistant keeper in the Science Museum, (a) one in the Department of Aeronautics and Sailing Ships and (b) one in the Department of Electrical Engineering and Communications. Appointments under (a) or (b) may be first or second class according to age and qualifications.

AGE at least 30 on October 1st, 1953, for a first-class post and at least 22 and under 26 on that date for second-class post, with extension for regular Forces service, compulsory Forces service, established Civil service and exceptionally well-qualified candidates.

CANDIDATES must have a University degree with first or second class honours: post (a) in engineering or aeronautical science; post (b) in electrical engineering. For post (a) about two years' practical experience in aeronautics or industry is required; for post (b) about two years' experience in industry. Knowledge of at least one modern foreign language would be an advantage for either post.

INCLUSIVE salary scale: assistant keepers second class —men, £440 to £655; women, £440 to £549. In certain circumstances candidates may be appointed direct to the grade of assistant keeper first class (inclusive salary scales: men, £844 to £1,331; women, £712 to £1,162; starting pay at the minimum).

STARTING pay may be increased for approved post-graduate experience and for compulsory service with H.M. Forces. Promotion prospects.

PARTICULARS and application forms may be obtained from the Secretary, Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London W.1, quoting No. S134/54. Application forms to be returned by December 23rd, 1953. [1364

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen and stressmen for work on this interesting programme. Good welfare facilities, including staff pension scheme.—Write, giving details of experience and salary required, to Personnel Manager. [0595

ARMSTRONG SIDDELEY MOTORS, Coventry, have vacancies for a number of designers and senior and junior draughtsmen. Although gas turbine experience is most advantageous it is not necessarily essential as training will be given in this specialized work to suitably qualified draughtsmen.—Apply in detail to Reference F.103, Personnel Manager, Armstrong Siddeley Motors, Coventry. [0200

AERONAUTICAL engineer, with Degree and some industrial design experience on modern aircraft, required immediately by firm engaged on the design and development of the latest aircraft instruments for the Ministry and commercial organizations. Position offers wide scope for initiative. Salary according to experience and qualifications. Croydon area.—Apply, Box 2030. [1360

ARMSTRONG SIDDELEY MOTORS Stress Department have vacancies for interesting and important work on gas turbine aero engines. This work covers all aspects of the strength and reliability of the engines and their installations, and is carried out in direct contact with the design and experimental departments. Degree in mathematics or engineering, or H.N.C. or its equivalent required. No experience necessary, but useful experience in design, stressing, experimental or practical work will be taken into account in fixing suitable and progressive salary.—Reply to Reference DRE.3, Personnel Manager, Armstrong Siddeley Motors, Coventry. [1143

SALE BY AUCTION
on Thursday, December 10th at 1 o'cl.
The Important Collection of
BOOKS
RELATING TO AERONAUTICS
formed by
LT.-COL. LOCKWOOD MARSH, F.R.Ae.S.
comprising
Early books on Mythology and Legendary Flight; Rare books on Early Scientific Experiments and Attempts at Flight; Veranzio's Machinae Novae, 1595; The Writings of Roger Bacon, Hooke, Lana, Baptista Porta, Wilkins, Glanvill, Borelli and others; books by, or relating to, Early Balloonists, including Faujas de St. Fond, Pilatre de Rozier, Blanchard, Lunardi; History and Bibliography, including Bruel's Histoire Aeronautique; Important Periodical Publications, including The Royal Aeronautical Society's Journal, 1897-1943; Aeronautics, 1907-1919; a set of *Flight* from the commencement in 1909 to 1948; L'Aerophile, from 1893 to 1923, etc.
Catalogues (price 3d.) sent on application
HODGSON & CO.
Sale Rooms: 115 Chancery Lane, London, W.C.2

ADCOLA
(Regd. Trade Mark)

SOLDERING INSTRUMENTS
SOUND Joints for SOUND Equipment
Any voltage range supplied 6/7 to 230/250
- Standard model for radio maintenance, etc. Detachable bit type. (Factory Bench Line)
- Equally suited to daily or intermittent use
- Consumption: 25 watts
- Total length of instruments 9 inches

Made in England Registered Design British, U.S.A., & Foreign Patents
- *Apply Sole Manufacturers and Suppliers*

ADCOLA PRODUCTS LTD.
Sales, Offices & Works: *MACaulay 4272*
CRANMER COURT, CLAPHAM HIGH ST., S.W.4

FREE! TO AMBITIOUS ENGINEERS 144-PAGE BOOK

Full details of the easiest and quickest way to prepare for A.F.R.Ae.S., A.R.B. Licences, B.Sc.(Eng.), A.M.I.Mech.E., City & Guilds, and hundreds of Home Study Courses in all branches of Aeronautical, Mechanical & Electrical Eng., Draughtsmanship, R.A.F. Maths., etc., are given in this valuable book. Our Courses have been approved by Royal Aeronautical Society and many B.I.E.T. Students have obtained First Places in the A.F.R.Ae.S. Exams.
We definitely Guarantee
NO PASS—NO FEE
A copy of this enlightening Guide to well-paid posts will be sent on request—FREE! Write: **B.I.E.T., 306a, SHAKESPEARE HOUSE, 19, STRATFORD PLACE, LONDON, W.1.**
BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

AIRCRAFT SPRING WASHERS

TO B.S.A. SPECIFICATION S.P.47
CROSS MFG. CO. (1938) LTD., COMBE DOWN, BATH

SITUATIONS VACANT

JUNIOR and intermediate stressmen with educational standard to Higher National Certificate, required for work on super priority aircraft contracts. The office location is in London and salaries of up to £700 p.a. are visualized. Assistance with accommodation will be given.—Write, stating age and full particulars, to: Box AC85843, Samson Clarks, 57/61 Mortimer Street, W.1. [1362

SENIOR and intermediate draughtsmen with educational standard to Higher National Certificate, required for work on super priority aircraft contracts. The office location is in London and salaries of up to £750 p.a. are visualized. Assistance with accommodation will be given.—Write, stating age and full particulars, to: Box AC85841, Samson Clarks, 57/61 Mortimer Street, W.1. [1363

HANDLEY PAGE (READING), Ltd., The Aerodrome, Woodley, Reading, have an immediate vacancy for a senior aircraft electrical draughtsman for work on an interesting new project. Only those who are fully experienced in all aspects of the work should apply, and for the successful applicant there will be suitable housing accommodation provided.—Please send full particulars of experience, etc., to the Personnel Officer. [0235

TECHNICAL assistant for production departments manufacturing aircraft fire protection equipment and associated small electrical/mechanical aircraft components. Age, preferably not more than 35. Higher National Certificate or equivalent essential.—Apply in writing to: Graviner Colnbrook, Poyle Mill Works, Colnbrook, Bucks (quote Ref. RWS 1153), and also through The General Secretary, A.E.S.D. Onslow Hall, The Little Green, Richmond. [1361

CHIEF inspector required by important aircraft company. Applicants must have held similar position with large aircraft firm and must have had considerable administrative experience. Full knowledge of A.I.D. and A.R.B. procedures essential. Good prospects for successful applicant. Pension scheme.—Write in confidence, giving full particulars of previous appointments held, qualifications, age and salary required, to Personnel Manager, Box 1984. [1345

HISPANO SUIZA'S associate company in England, British Manufacture and Research Co., Ltd., of Grantham, urgently requires design staff for development work connected with light gunnery and fire-control equipment. General design ability is valued higher than specific design experience in gunnery equipment. The conditions are attractive.—Applications to be addressed: British Manufacture and Research Co., Ltd., Grantham, Lincs. Ref. AWK/53. [1338

FERRANTI, Ltd., Edinburgh, have a vacancy for a senior stress engineer for work in connection with the installation of experimental equipment in aircraft. Applicants should possess a degree or equivalent and must have experience in aircraft stress office work. Interesting work offering good prospects. Staff pension scheme.—Apply, giving full details of training and experience, and quoting Ref. SE/DDO, to the Personnel Officer, Ferranti, Ltd., Crewe Toll, Edinburgh 5. [1357

PILOT for a company's executive aircraft to commence duties in January, 1954. Applicants should hold a senior commercial pilot's licence or above, and current instrument rating. Preference will be given to applicants with a Group I rating for Dove aircraft and who have previous experience on this type of work. Permanent appointment. Staff pension scheme. Location, S.E. Scotland.—Apply, quoting Ref. "T.P.", state age and give full details of training, qualifications, etc., to Box 1917. [1328

GRAVINER, Colnbrook, have a number of staff vacancies in connection with an interesting programme of work on their internationally-known airborne fire protection equipment and on other projects of a similar nature. The work comprises both basic research and development work on fire extinguishers, fire and overheat detectors, crash-operated devices and other small aircraft components of similar nature. Vacancies exist for: (1) Development engineers and physicists with honours degree in mechanical or electrical engineering or physics, and several years' experience in development or research. Age preferably 25-35. (2) Technical assistants with minimum qualification of pass degree or H.N.C. A staff pension scheme is in operation and the company has its own sports field and canteens.—Apply in writing to Chief Development Engineer, "Graviner, Colnbrook," Colnbrook, Bucks. [1378

SITUATIONS WANTED

PILOT, senior commercial pilot's licence, instrument rating, instructor's endorsement, 3,000 hours, 45 types of aircraft flown, seeks situation.—Box 2086. [1367

SENIOR aeronautical draughtsman, recently recovered from breakdown, will accept junior position to get re-established.—Box "R," Harwood Press, 47 West Street, Harrow. [1369

WELDER, 22 years' experience, shipyard, aircraft, jet (arc, gas, argon), seeks change. Good working conditions and strict first-class work preferred.—Box 2106. [1377

BUSINESS executive, age 34, possessing all round aviation experience, including Commercial Pilot's Licence, desires senior position either sales or administrative. At present general manager of old-established firm.—Box 2029. [1359

APPLICATIONS ARE INVITED

for a number of senior positions in the Guided Weapon field

Posts are permanent and will be offered to suitable applicants who have either at least 5 years' experience in industry or are Graduates with two or more years' experience.

Salaries will be commensurate with experience and advancement will depend upon original contribution and enthusiasm for the work.

The following positions are available:

(a) PHYSICIST with experience in electronics.

(b) CIRCUIT ENGINEER capable of original circuit development and familiar with low frequency circuit designs and miniaturisation, and

(c) SERVO ENGINEER experienced in design and development of light electrically controlled servo-mechanism.

Apply: Box AC. 85669,
SAMSON CLARKS,
57/61 Mortimer Street,
London W.1.

INDUSTRIAL JRS DESIGNERS

J. R. STAINES
& PARTNERS LTD
BATH AND SALISBURY

AIRCRAFT DESIGN
JIG & TOOL DESIGN
SPECIAL PURPOSE MACHINES
STRUCTURAL ENGINEERING

EXPERIENCED TECHNICAL STAFF

LONDON OFFICE
115 ST. STEPHEN'S HOUSE
WESTMINSTER, S.W.1
TRA 4994-5

U.S.A. HEADPHONES

Type H.S.33
£6 10 0 per set

HAND MIKES

Type 17B
£5 18 0 per set

For immediate delivery ex stock

Staravia
BLACKBUSHE AIRPORT
CAMBERLEY, SURREY
Tel: Camberley 1600

STANDARD AIRCRAFT PARTS

CURD COMPONENTS LTD.
58, VICTORIA STREET, ST. ALBANS, HERTS.

BOOKS, ETC.

BACK numbers of *Flight*, Nos. 1 to 50 for sale. What offers?—Spencer, Phillack, Hayle, Cornwall. [1327

"MATERIAL Handling in Works Stores," by L. J. Hoefkens. Shows how the use of fork-lift trucks and pallets in industrial stores can increase production, utilize floor space more effectively, help control of movement and reduce costs. Includes a description of a system actually operated in a modern factory. 10s. 6d. net from all booksellers. By post 10s. 11d. from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"RALLIES and Trials," by S. C. H. Davis of "The Autocar." Describes in a colourful style the author's many adventures whilst driving in rallies and trials in all parts of Britain and Europe. The Monte Carlo Rally, the exciting Alpine Trials and many other spectacular events are recalled by this world-renowned racing driver. 15s. net from all booksellers. 15s. 7d. by post from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"ROADS of France: A Guide to Tourist Routes," by A. G. Douglas Clease. A handy-size book which enables the France-bound motorist to find his way to the more popular tourist areas without worry or trouble. It also gives helpful information about hotels, charges and tips and other valuable hints for the first-time visitor. 5s. net from all booksellers. By post 5s. 2d. from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"A RACING Motorist: His Adventures at the Wheel in Peace and War," by S. C. H. Davis of "The Autocar." An exciting book of speed and thrills by a racing driver of international repute who secured notable successes in the golden days of trials and road racing between the wars. The author includes his war experiences, as they seemed just a continuation of racing in another dress and in different circumstances. 216 pages, including 32 pages of photogravure illustrations. Price 10s. 6d. net. By post 11s. from all booksellers or from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"FELLOWSHIP of the Air: Jubilee Book of the Royal Aero Club," by B. J. Hurren. The story of the Royal Aero Club of the United Kingdom, from its founding in 1901, through the two world wars, to its post war resurgence. The book is a tribute to those men and women who have kept Britain foremost in the air. 30s. net from all booksellers. 31s. 2d. by post from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"BRIGHTER Photography for Beginners," by David Charles, F.R.P.S. Describes the whole photographic process without tedious explanations of optics, physics, chemistry or mathematics. This new edition, revised throughout and lavishly illustrated, is the obvious choice for those who want a non-technical explanation of how to succeed with a camera. Fourth Edition, 6s. net from all booksellers. By post 6s. 4d. from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"PHOTOGRAMMETRIC Mapping from Air Photographs." By the Technical Staff of Hunting Aerosurveys Ltd. A simple explanation of the technique by which contour maps and plans are prepared from air photographs. The text is fully illustrated with 35 diagrams and photographs, and a pair of stereoscopic spectacles is supplied with the book. 7s. 6d. net from all booksellers. By post 7s. 9d. from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

"CELESTIAL Navigation for Yachtsmen." 2nd Edition. By M. Blewitt. This little book, intended especially for beginners, should receive a very warm welcome from every yachtsman who has wanted to learn the art of navigation by the heavenly bodies, but has been deterred by its apparent complexity. In particular, it will make an immediate appeal to all who feel their mathematics are not up to standard, for neither geometry nor trigonometry play any part in the author's explanation—indeed, even those who can manage little more than addition and subtraction should master this book with ease! 62 pages. Illustrated with 26 diagrams and graphs. Price 5s. net. By post 5s. 3d. from all booksellers, or Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

The New 1954 'FLIGHT LIEUTENANT' HANDLESS WATCH

No Glass, No Dial, No Hands

Built for strength, fitted with aircraft shock-resisting movement. Lever escapement. Anti-magnetic and recoil click spring to prevent over-winding. Encased handsome chrome case. Expanding bracelet 10/6 extra if required. Time shown by revolving figures. Sent for 5/- dep. Bal. 10/- monthly. Non-Luminous night dial 6/6 extra. Mfrs. Full Guar. Cash price 79/6. Post etc., 1/3.

Free Illustrated Lists of other Watches, Binoculars, Tents, Suiting Patterns, Radios, Toys, etc. Terms. State Lists required.

HEADQUARTER & GENERAL SUPPLIES LTD.
(Dept. FLI 13), 196-200 Coldharbour Lane,
Loughborough Junction, London, S.E.5.
Open all Saturday 1 p.m. Wednesday

FISHERS

RECONDITIONED DEPT.

offers a splendid selection of

ALMOST NEW

R.A.F. OFFICERS' KIT

AT A FRACTION OF ORIGINAL COST

Latest Style
CROMBIE GREATCOATS
No. 1 UNIFORMS
TROPICAL KIT
CAPS and FOOTWEAR

Please write for Price Lists

86/88 WELLINGTON STREET, WOOLWICH, LONDON, S.E.18
Phone: Woolwich 1055

BROOKLANDS AVIATION LTD.

SYWELL - NORTHAMPTON

require urgently

EX R.A.F. or R.N.A.S.
AIRFRAME FITTERS
TINSMITHS
TECHNICAL CONTROL
and
STORES CLERICAL

for new production and repair work on jet and piston engined aircraft

Regular work with piecework bonus and Overtime

APPLY TO:
Brooklands Aviation Ltd.,
Buttocks Booth, Moulton,
Northampton

REFUELLING EQUIPMENT FOR SALE

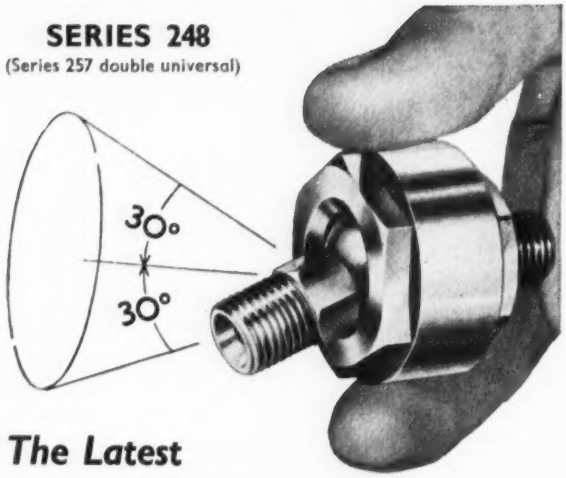
500 gallon T.B. Self Mobile Refuellers.
900 gallon Brockhouse Trailers.
900 gallon Bedford Q.L. Tankers.

Above fully reconditioned to "as new" standards, supplied with six months' guarantee.

Also Coles Cranes, lorry mounted and self mobile, crane repairs, spares and sales.

DERBY AVIATION LIMITED
Derby Airport, Burnaston, Derby

SERIES 248
(Series 257 double universal)



The Latest

UNIVERSAL HIGH PRESSURE COUPLING

Duralumin, brass, stainless or mild steel. Sizes ¼" to 2" BSP or to requirements. For services air, gas, hydraulic fluids and acids. Maximum test pressure 6000 PSI. Working pressure 4000 PSI.

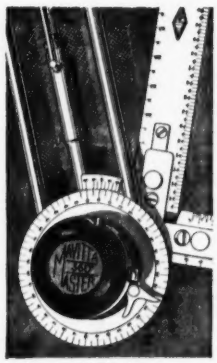
A.I.D. approved and Contractors to M.o.S.

I.V. PRESSURE CONTROLLERS LTD
FORGE WORKS, 844, BATH ROAD
CRANFORD, MIDDLESEX *Phone* HAYES 2809-1203

J. J. BENSON

Aircraft Furnishers · Approved Dunlopillo Stockists and Handbuilders

872-876 LONDON ROAD
LEIGH-ON-SEA · ESSEX
Telephone Leigh-on-Sea 77423



MAVITTA
DRAFTING MACHINES

A complete range of Drafting Machines for Boards up to 50 feet long, both vertical and horizontal. Adjustable Drawing Stands and Boards. Mathematical Scales in various materials. Surveyor's Rods. Isometric Projection Machines.

THE MASTER — latest in our range — Linkage by steel bands and pulleys — 360 degrees rotation of index head — automatic location of main angles by press button through knob — quick release of head for lining up to drawings — counter-balanced for vertical use — modern styling and high quality finish.

THE MAVITTA DRAFTING MACHINES LTD.
HIGHLANDS ROAD · SHIRLEY · BIRMINGHAM
Phone: SOLIHULL 2231/2 Grams: Mavitta, B'ham

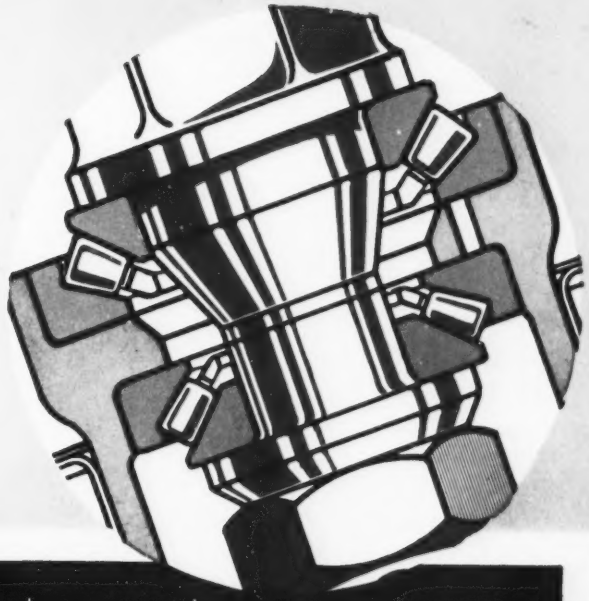
APPLY FOR CATALOGUE

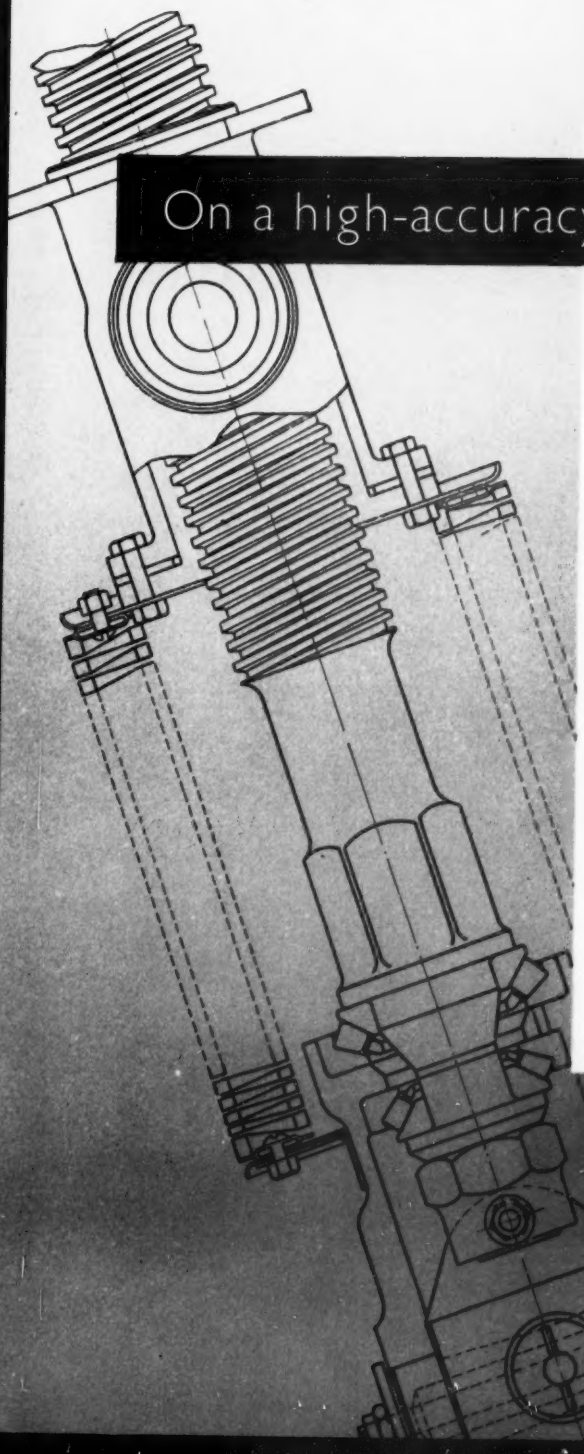
MIC

INDEX TO ADVERTISERS

	Page
Adcola Products, Ltd.	30
Airwork, Ltd.	23, 26, 28
Armstrong Siddeley Motors, Ltd.	15
Aviation Developments, Ltd.	8
Benson, J. J.	32
Blackburn and General Aircraft, Ltd.	29
Boulton Paul Aircraft, Ltd.	5
Box No. A.C. 85669	31
Bristol Aeroplane Co., Ltd., The	Cover iv
British Air Line Pilots' Association, The	26
British Emulsifiers, Ltd.	25
British Institute of Engineering Technology	30
British Timken, Ltd.	Cover iii
Brooklands Aviation, Ltd.	31
Brown and Co., Ltd., E. G.	4
Central Office of Information (Royal Navy)	8
Cross Manufacturing (1938), Ltd.	26, 30
Curd Components, Ltd.	31
De Havilland Aircraft Co., Ltd., The	16
Derby Aviation, Ltd.	31
Desoutter Brothers, Ltd.	20
Eagle Aircraft Services, Ltd.	28
English Electric Co., Ltd., The	17
Fairey Aviation Co., Ltd., The	11
Field Aircraft Services, Ltd.	27
Fishers	31
Folland Aircraft, Ltd.	19
Garringtons, Ltd.	9
General Electric Co., Ltd., The	22
Godfrey and Partners, Ltd., Sir George	1
Gosheron and Co., Ltd., John	6
Greenwood (Willesden), Ltd., P. W.	31
Headquarter and General Supplies, Ltd.	31
Hobson, Ltd., H. M.	29
Hodgson and Co.	30
I.V. Pressure Controllers, Ltd.	32
Kenton Equipment, Ltd.	6
K.L.M. Royal Dutch Airlines	4
Laycock Engineering, Ltd.	24
Lewis, Ltd., D.	26
Magnesium Elektron, Ltd.	2
Martin-Baker Aircraft, Ltd.	18
Mavitta Drafting Machines, Ltd., The	32
Napier and Son, Ltd., D.	10
Normalair, Ltd.	7
Northern Aluminium Co., Ltd.	12
Opperman, Ltd., S.E.	32
Plessey Co., Ltd., The	Cover i
Pressed Steel Co., Ltd.	25
Pyrene Co., Ltd., The	6
Rolls-Royce, Ltd.	13
Rotax, Ltd.	21
SAAB Aircraft Co.	14
Short Brothers and Harland, Ltd.	3
Sperry Gyroscope Co., Ltd.	28
Staines and Partners, Ltd., J. R.	31
Staravia	31
Sugg and Co., Ltd., William	8
Teddington Controls, Ltd.	24
Westland Aircraft, Ltd.	Cover ii

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.





On a high-accuracy heavy-duty screwjack

The drawings show an interesting use of Timken STW bearings, which have steeper race angles than the usual Timken bearings and, therefore, carry the high thrust load set up in an installation of this kind.

Adequate radial support is also afforded, ensuring the maximum stability of the bearing. These bearings are pre-loaded, and an economy in the size of one bearing has been possible, since the reverse load is considerably less than the main load.

One of the outstanding advantages of Timken STW bearings in an application of this kind is their low 'starting torque'.

BRITISH TIMKEN LTD.

DUSTON, NORTHAMPTON; AND BIRMINGHAM

Telephone: Northampton 4921 8. Telegrams: Britimken Phone Northampton

Subsidiary Companies: Fischer Bearings Co. Ltd., Wolverhampton Timken-Fischer Stockists Ltd., Birmingham

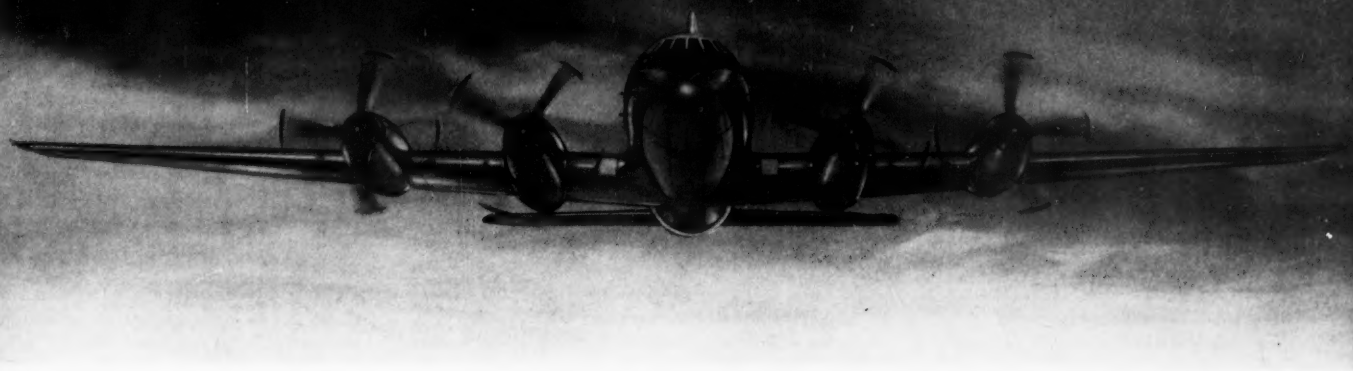
REGD. TRADE MARK: TIMKEN

MADE IN ENGLAND

TIMKEN

tapered-roller bearings

Britannia



chosen by

QANTAS

EMPIRE

AIRWAYS

Australia's Overseas Airline

THE *Bristol* AEROPLANE COMPANY LIMITED · ENGLAND

245A